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# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT Application of Mills — Group Art Unit: 2624

Application Ser. No. 09/220,970 — Examiner: W. Chen

Filed: 12/23/98

For: A METHOD AND SYSTEM FOR PATTERN RECOGNITION AND PROCESSING

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11 February 2008

## REPLY BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Appellant timely files this Reply Brief in response to the Examiner's new arguments raised in his Examiner's Answer mailed on 12 December 2007.

On pages 3-11 of the Examiner's Answer, the Examiner repeats his arguments from the Final Office Action mailed 21 December 2006, rejecting all of the pending claims under the following grounds: Claims 51-322 under 35 U.S.C. § 112, First Paragraph, and under 35 U.S.C. § 101, because they are allegedly non-operational and do not have utility; and claims 307-322 under 35 U.S.C. § 101, because the claimed invention is allegedly directed to non-statutory subject matter. In his previously filed Brief, Appellant rebutted each and every one of those arguments, and raised other glaring errors in the Final Rejection of record, which the Examiner's Answer fails to address or otherwise overcome.

In this Board's previous 22 March 2005 Decision, the Board specifically held that the claim term "Fourier Series in Fourier Space" had a specific definition that was disclosed in the originally filed application. See page 8 of that Decision, which states that "Fourier series in Fourier Space is a sum of trigonometric functions in frequency

space where each variable is frequency and the parameters of the Fourier series are input data or processed input data." Appellant respectfully submits that the Examiner simply ignores this clear definition in his Answer.

This is not the first time the Examiner has refused to carry out the directives of the Board. [See pages 1-2 of Appellant's Brief.] The Examiner's Answer does not address the Examiner's refusal to follow the Board's instructions, but rather, commits further error in failing to do so. For instance, as discussed more fully below, the Examiner improperly takes language from the background of the invention relating to conventional Fourier Transforms, and then attempts to pass off conventional Fourier Transforms as Appellant's invention (Fourier Series in Fourier Space) to support his erroneous rejections. A clear difference between conventional Fourier Transforms and Appellants Fourier Series in Fourier Space has been provided on pages 61-65 of Appellant's Brief, which the Examiner simply ignores.

The Examiner also concludes, without basis, that Appellant's invention does not work. Once again, Appellant submits that the originally filed application provides a working example and exemplary equations. All one skilled in the art need do is plug in the data parameters and solve the exemplary equations to recognize a pattern in the data to practice the claimed invention. The Examiner fails to show otherwise.

Based on these and other clear errors found throughout the Examiner's Answer—many of which raise new issues for the first time on appeal—Appellant respectfully requests that the Board overturn the Examiner's Final Rejection and direct the Examiner to allow all of Appellant's pending claims 51-322.

Appellant now responds to the new arguments raised by the Examiner in his Answer.

The Examiner first addresses the rejection of claims 51-322 under 35 U.S.C. § 112, First Paragraph. In connection with "section a" on page 4 of the Office Action mailed 12/21/08, the Examiner argues on page 14 of the Answer that:

> In page 4 of the Office Action mailed 12/21/2006, the Examiner pointed out no adequate description is given in the passage in lines 18-25 of page 11 that "the characteristic modulation is encoded as a delay in time by storing the Fourier series in a specific portion of the Input layer section of the memory wherein the specific portion has n+1 sub time

intervals." What specific function is used? And how the encoding is performed?

Appellant's argument –

In pages 40-43 of the present Brief, the Appellant cited many portions of the specification for answering the questions. Specifically, the Appellant stated, "Thus, it is apparent to one skilled in the art that the encoding can be provided by a specific modulation frequency tag of the Fourier series, which corresponds to a specific time delay that is recorded in the appropriately designated section of memory having "n+l sub time intervals".

Examiner's response –

A specific **modulation frequency tag was never mentioned in the original specification.** There was no relationship given between a specific modulation frequency tag and a specific time delay. The passage in lines 18-25 of page 11 clearly shows that no frequency tag was provided. When the characteristic modulation is **encoded as a delay in time,** it means that the time delay can be decoded to retrieve the frequency information. This is also shown in passages related equation (37.109) in page 40 of the specification. Therefore, if a specific time delay can be used for decoding frequency information, one skilled in the art do not need a specific modulation frequency tag because it is redundant and wastes memory space and process resource.

The Examiner's response is grossly in error. The modulation tag is described specifically in the Application as a means to encode specific information, such as context in a novel manner. Appellant teaches "the characteristic modulation having a frequency within the band in Fourier space is represented by $e^{-j2\pi f t_0}$. The modulation corresponds to the time delay $\delta(t-t_0)$ wherein $f$ is the frequency variable, $t$ is the time variable, and $t_0$ is the time delay. The characteristic modulation is encoded as a delay in time by storing the Fourier series in a specific portion of the Input Layer section of the memory wherein the specific portion has $n+1$ sub time intervals. Each sub time interval corresponds to a frequency band." See for example the present disclosure at page 10, line 12 to page 12, lines 2:

The physical context is conserved by mapping with a one to one basis between the physical context and the input context based on the identity of each transducer. The input context is conserved by

mapping on a one to one basis to the Input Layer section 24 of memory 20. In an embodiment, the input context is encoded in time as a characteristic modulation frequency band in Fourier space of the Fourier series. The characteristic modulation frequency band in Fourier space represents the input context according to the identity of a specific transducer of the relationship of two transducer elements. The modulation within each frequency band may encode not only input context but context in a general sense. The general context may encode temporal order, cause and effect relationships, size order, intensity order, before-after order, top-bottom order, left-right order, etc. all of which are relative to the transducer.

Still referring to FIGURE 3, the transducer has $n$ levels of subcomponents. Each transducer is assigned a portion 26 of the Input Layer section 24 of the memory 20. The memory 20 is arranged in a hierarchical manner. Specifically, the memory is divided and assigned to correspond to a master time interval with $n+1$ sub time intervals. The hierarchy parallels the $n$ levels of the transducer subcomponents. The $n$ th level transducer sub component provides a data stream to the system 10. The data stream is recorded as a function of time in the $n+1$ sub time interval. The time intervals represent time delays which correspond to the characteristic modulation frequency band in Fourier space which in turn represents the input context according to the specific transducer or transducer subcomponent.

An exemplary complex transducer which may be represented by a data structure comprising a hierarchical set of time delay intervals is a CCD array of a video camera comprising a multitude of charge coupled devices (CCDs). Each CCD comprises a transducer element and is responsive to light intensity of a given wavelength band at a given spatial location in a grid. Another example of a transducer is an audio recorder comprising transducer elements each responsive to sound intensity of a given frequency band at a given spatial location or orientation. A signal within the band 300-400 MHz may encode and identify the signal as a video signal; whereas, a signal within the band 500-600 MHz may encode and identify the signal as an audio signal. Furthermore, a video signal within the band 315-325 MHz may encode and identify the signal as a video signal as a function of time of CCD element (100,13) of a 512 by 512 array of CCDs.

In one embodiment, the characteristic modulation having a frequency within the band in Fourier space is represented by $e^{-j2\pi f t_0}$. The modulation corresponds to the time delay $\delta(t-t_0)$ wherein $f$ is the frequency variable, $t$ is the time variable, and $t_0$ is the time delay. The characteristic modulation is encoded as a delay in time by storing the Fourier series in a specific portion of the Input Layer section of the memory wherein the specific portion has $n+1$ sub time intervals. Each sub time interval corresponds to a frequency band.

In an alternative embodiment, the characteristic modulation, having a frequency within the band is represented by $e^{-jk_\rho(\rho_{fb_m}+\rho_{t_m})}$. Thus, the Fourier series in Fourier space may be:

$$\sum_{m=1}^{M}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}a_{0_m}N_{m_{\rho_0}}N_{m_{z_0}}e^{-jk_\rho(\rho_{fb_m}+\rho_{t_m})}\sin\left(k_\rho\frac{N_{m_{\rho_0}}\rho_{0_m}}{2}-n\frac{2\pi N_{m_{\rho_0}}}{2}\right)\sin\left(k_z\frac{N_{m_{z_0}}z_{0_m}}{2}-n\frac{2\pi N_{m_{z_0}}}{2}\right)$$

wherein $\rho_{t_m}=v_{t_m}t_{t_m}$ is the modulation factor which corresponds to the physical time delay $t_{t_m}$, $\rho_{fb_m}=v_{fb_m}t_{fb_m}$ is the modulation factor which corresponds to the specific transducer time delay $t_{fb_m}$, $v_{t_m}$ and $v_{fb_m}$ are constants such as the signal propagation velocities, $a_{0_m}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, and $M$ are integers, and $N_{m_{\rho_0}}$, $N_{m_{z_0}}$, $\rho_{0_m}$, and $z_{0_m}$ are data parameters. The data parameters are selected in the same manner as described above.

Thus, there is a clear disclosure in the originally filed application teaching that the modulation tag can be a means to encode specific information such as context in a novel manner.

On page 15 of the Answer, the Examiner again erroneously argues that:

> As shown in Fig. 3 of the specification, the frequency information is key for data structure (arrange) for manipulating and retrieval of data. Without knowing how to implement this step, the specification cannot enable one to use the method.

This is simply not true. Appellant precisely teaches how the data structure relates to time delays and corresponding frequencies to encode information such as context. See page 10, lines 12-25 of the present application, which discloses that:

> The physical context is conserved by mapping with a one to one basis between the physical context and the input context based on the identity of each transducer. The input context is conserved by mapping on a one to one basis to the Input Layer section 24 of memory 20. In an embodiment, the input context is encoded in time as a characteristic modulation frequency band in Fourier space of the Fourier series. The characteristic modulation frequency band in Fourier space represents the input context according to the identity of a specific transducer of the relationship of two transducer elements. The modulation within each

frequency band may encode not only input context but context in a general sense. The general context may encode temporal order, cause and effect relationships, size order, intensity order, before-after order, top-bottom order, left-right order, etc. all of which are relative to the transducer.

Thus, contrary to the Examiner's position, the specification precisely teaches how the data structure relates to time delays and corresponding frequencies to encode information such as context.

In connection with "section b" on page 4 of the Office Action mailed 12/21/06, the Examiner argues on pages 15-16 of the Answer that:

> Appellant's argument --
>
> For this aspect, the Examiner has it completely wrong. While the layers may function independently of each other, the preferred embodiment comprises their use in concert. For example, it is possible to perform associations in the Association Layer without its activation controlled by the Predominant Configuration Layer, and Strings can be ordered independently in the String Ordering Layer independent of both. The Appellant further stated that, "In fact, an embodiment of Appellant's invention has been through exhaustive peer review and is published in the artificial intelligence literature, a higher standard than required by the U.S. Patent and Trademark Office. Thus, the PhD referees and the Journal have agreed that Appellant's invention teaches a novel, operative development in this field. See R. L. Mills, "Novel Method and System for Pattern Recognition and Processing Using Data Encoded as Fourier Series in Fourier Space", Engineering Applications of Artificial Intelligence, Vol. 19, (2006), pp. 219-234."
>
> Examiner's response --
>
> The Examiner disagreed with the conclusion. Fig. 1 of the present application shows the high level (most basic) structure of the invention. In page 1, the Appellant stated that the invention is directed to a method and system for pattern recognition. How can one, who has a problem of implementing any of an input layer, an association layer, a string ordering layer, a predominant configuration layer, and a memory, implement the proposed method which is used to support any of Claims 51-322 to achieve the utility of pattern recognition?

As a counter example to the Examiner's position that the layers can not function independently, consider that the association layer can recognize a pattern independently of the other layers. The method is described on page 13, line 1 to page 16, line 12 of the present application as follows:

> Referring again to Figure 2, several parameterized Fourier components are input to the Association Layer to form associations of the Fourier series. The Fourier components may be stored in a Fourier component section 30 of a temporary memory section 28. The Fourier components are added to form multiple Fourier series which in turn may be stored in a Fourier series section 32 of the temporary memory section 28. At least one of the Fourier series stored in the Fourier series section 32 is input to a filter 34 wherein the filter 34 samples and modulates the Fourier series. The filtered Fourier series is input to a spectral similarity analyzer 36. The spectral similarity analyzer 36 determines the spectral similarity between the filtered Fourier series and another Fourier series stored in the Fourier series section 32 of the temporary memory section 28. A spectral similarity value is output from the spectral similarity analyzer 36 and input to a probability expectation analyzer 38. The probability expectation analyzer 38 determines a probability expectation value based on the spectral similarity value. The probability expectation value output from the probability expectation analyzer 38 is input to a probability operand generator 40. The probability operand generator 40 generates a probability operand value of one or zero based upon the probability expectation value. The probability operand value is output to a processor 42. If the probability operand value is zero, the processor 42 sends another Fourier series from the Fourier series section 32 of the temporary memory section 28 to the filter 34 and begins the process again. If the probability operand value is one, the filtered Fourier series and the other Fourier series are added to form a string and the string is stored in a string memory section 44.
>
> The filter 34 can be a time delayed Gaussian filter in the time domain. The filter may be characterized in time by:
>
> $$\frac{\alpha}{\sqrt{2}\pi} e^{\frac{\left(t-\frac{\sqrt{N}}{\alpha}\right)^2}{\frac{2}{\alpha^2}}}$$
>
> wherein $\frac{\sqrt{N}}{\alpha}$ is a delay parameter, $\alpha$ is a half-width parameter, and $t$ is the time parameter. The Gaussian filter may comprise a plurality of cascaded stages each stage having a decaying exponential system function between stages. The filter, in frequency space, can be characterized by:

$$e^{-\frac{1}{2}\left(\frac{2\pi f}{\alpha}\right)^2} e^{-j\sqrt{N}\left(\frac{2\pi f}{\alpha}\right)}$$

wherein $\frac{\sqrt{N}}{\alpha}$ and $\alpha$ are a corresponding delay parameter and a half-width parameter in time, respectively, and $f$ is the frequency parameter. The probability distribution may be Poissonian. Thus, the probability expectation value can be based upon Poissonian probability. The probability expectation value may be characterized by

$$\prod_s \left[ p_{\uparrow_s} + \left(P - p_{\uparrow_s}\right) \exp\left[-\beta_s^{-2}\left(\frac{1-\cos 2\phi_s}{2}\right)\right] \cos\left(\delta_s + 2\sin\phi_s\right) \right]$$

wherein $P$ is the maximum probability of at least one other Fourier series being associated with a first Fourier series, $p_{\uparrow_s}$ is a probability of at least one other Fourier series being associated with a first Fourier series in the absence of coupling of the first Fourier series with the at least one other Fourier series, $\beta_s^2$ is a number that represents the amplitude of spectral similarity between at least two filtered or unfiltered Fourier series, $\phi_s$ represents the frequency difference angle between at least two filtered or unfiltered Fourier series, and $\delta_s$, is a phase factor. $\beta_s^2$ may be characterized by

$$\beta_s^2 = (8\pi)^2 \frac{1}{\sqrt{2\pi}} \sqrt{\frac{\alpha_1^2 \alpha_s^2}{\alpha_1^2 + \alpha_s^2}}$$

$$\sum_{m_1=1}^{M_1} a_{0_{m_1}} N_{m_1} \sum_{m_s=1}^{M_s} a_{0_{m_s}} N_{m_s} \exp - \left\{ \frac{\frac{\alpha_1^2 \alpha_s^2}{\alpha_1^2 + \alpha_s^2} \left( \frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \frac{N_{m_1} \rho_{0_{m_1}}}{2 v_{m_1}} - \frac{N_{m_s} \rho_{0_{m_s}}}{2 v_{m_s}} \right)^2}{2} \right\}$$

$\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$ and $M_s$ are integers, $a_{0_{m_1}}$ and $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above. $\phi_s$ may be characterized by

$$\phi_s = \frac{\pi\left( \frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \sum_{m_1=1}^{M_1} \frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} - \sum_{m_s=1}^{M_s} \frac{N_{m_s}\rho_{0_{m_s}}}{2v_{m_s}} \right)}{\frac{\sqrt{N_1}}{\alpha_1} + \sum_{m_1=1}^{M_1} \frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}}}$$

$\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$ and $M_s$ are integers, $a_{0_{m_1}}$ and $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above.

An exemplary string with a characteristic modulation having a frequency within the band represented by $e^{-jk_\rho(\rho_{fb_m}+\rho_{t_m})}$ is:

$$\sum_{s=1}^{S}\sum_{m=1}^{M_s}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}a_{0_{s,m}}N_{s,m_{\rho_0}}N_{s,m_{z_0}}e^{-jk_\rho\left(\rho_{fb_{s,m}}+\rho_{t_{s,m}}\right)}$$
$$\sin\left(\left(k_\rho-n\frac{2\pi}{\rho_{0_{s,m}}}\right)\frac{N_{s,m_{\rho_0}}\rho_{0_{s,m}}}{2}\right)\sin\left(\left(k_z-n\frac{2\pi}{z_{0_{s,m}}}\right)\frac{N_{s,m_{z_0}}z_{0_{s,m}}}{2}\right)$$

wherein $\rho_{t_{s,m}}=v_{t_{s,m}}t_{t_{s,m}}$ is the modulation factor which corresponds to the physical time delay $t_{t_{s,m}}$, $\rho_{fb_{s,m}}=v_{fb_{s,m}}t_{fb_{s,m}}$ is the modulation factor which corresponds to the specific transducer time delay $t_{fb_{s,m}}$, $v_{t_{s,m}}$ and $v_{fb_{s,m}}$ are constants such as the signal propagation velocities, $a_{0_{s,m}}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, $s$, $M_s$, and $S$ are integers, and $N_{s,m_{\rho_0}}$, $N_{s,m_{z_0}}$, $\rho_{0_{s,m}}$, and $z_{0_{s,m}}$ are data parameters. The data parameters are selected in the same manner as described above.

An exemplary string with each Fourier series multiplied by the Fourier transform of the delayed Gaussian filter represented by $e^{-\frac{1}{2}\left(v_{s\rho0}\frac{k_\rho}{\alpha_{s\rho0}}\right)^2}e^{-j\frac{\sqrt{N_{s\rho0}}}{\alpha_{s\rho0}}(v_{s\rho0}k_\rho)}e^{-\frac{1}{2}\left(v_{sz0}\frac{k_z}{\alpha_{sz0}}\right)^2}e^{-j\frac{\sqrt{N_{sz0}}}{\alpha_{sz0}}(v_{sz0}k_z)}$ that established the association to form the string is:

$$\sum_{s=1}^{S}\sum_{m=1}^{M_s}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}a_{0_{s,m}}N_{s,m_{\rho_0}}N_{s,m_{z_0}}e^{-\frac{1}{2}\left(v_{s\rho0}\frac{k_\rho}{\alpha_{s\rho0}}\right)^2}e^{-j\frac{\sqrt{N_{s\rho0}}}{\alpha_{s\rho0}}(v_{s\rho0}k_\rho)}e^{-\frac{1}{2}\left(v_{sz0}\frac{k_z}{\alpha_{sz0}}\right)^2}e^{-j\frac{\sqrt{N_{sz0}}}{\alpha_{sz0}}(v_{sz0}k_z)}$$
$$e^{-jk_\rho\left(\rho_{fb_{s,m}}+\rho_{t_{s,m}}\right)}\sin\left(\left(k_\rho-n\frac{2\pi}{\rho_{0_{s,m}}}\right)\frac{N_{s,m_{\rho0}}\rho_{0_{s,m}}}{2}\right)\sin\left(\left(k_z-n\frac{2\pi}{v_{s,m}t_{0_{s,m}}}\right)\frac{N_{s,m_{z0}}z_{0_{s,m}}}{2}\right)$$

wherein $v_{s\rho0}$ and $v_{sz0}$ are constants such as the signal propagation velocities in the $\rho$ and $z$ directions, respectively, $\frac{\sqrt{N_{s\rho0}}}{\alpha_{s\rho0}}$ and $\frac{\sqrt{N_{sz0}}}{\alpha_{sz0}}$ are

> delay parameters and $\alpha_{s\rho 0}$ and $\alpha_{sz0}$ are half-width parameters of a corresponding Gaussian filter in the $\rho$ and $z$ directions, respectively, $\rho_{t_{s,m}} = v_{t_{s,m}} t_{t_{s,m}}$ is the modulation factor which corresponds to the physical time delay $t_{t_{s,m}}$, $\rho_{fb_{s,m}} = v_{fb_{s,m}} t_{fb_{s,m}}$ is the modulation factor which corresponds to the specific transducer time delay $t_{fb_{s,m}}$, $v_{t_{s,m}}$ and $v_{fb_{s,m}}$ are constants such as the signal propagation velocities, $a_{0_{s,m}}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, $s$, $M_s$, and $S$ are integers, and $N_{s,m_{\rho 0}}$, $N_{s,m_{z0}}$, $\rho_{0_{s,m}}$, and $z_{0_{s,m}}$ are data parameters. The data parameters are selected in the same manner as described above.
>
> Therein, the Association Layer forms associations between Fourier series and sums the associated Fourier series to form a string. The string is then stored in the string memory section.

As Appellant's disclosure makes clear, he output of associations between Fourier series in Fourier space constitutes the recognition of a pattern in the processed information.

As another counter example to the Examiner's position that the layers can not function independently, consider that the string ordering layer can recognize a pattern independently of the other layers. Such a method is described on page 16, line 16 to page 21, line 8 of the present application as follows:

> The next aspect of the present invention is the ordering of the strings stored in the string memory section 44. The ordering may be according to any one of the following: temporal order, cause and effect relationships, size order, intensity order, before-after order, top-bottom order, or left-right order. Referring to FIGURE 4, the method for ordering the strings stored in the string memory section 44 entails the following:
>
> a.) obtaining a string from the string memory section 44 and storing the string to a temporary string memory section 46;
>
> b.) selecting at least two filters 48, 50 from a selected set of filters 52;
>
> c.) sampling the string with the filters 48, 50, each of the filters forming a sampled Fourier series, each Fourier series comprising a subset of the string;
>
> d.) modulating each of the sampled Fourier series in Fourier space with the corresponding selected filter 48, 50, each forming an order formatted Fourier series;
>
> e.) adding the order formatted Fourier series to form a summed Fourier series in Fourier space;
>
> f.) obtaining an ordered Fourier series from the High Level Memory section 54;

g.) determining a spectral similarity with a spectral similarity analyzer 56 between the summed Fourier series and the ordered Fourier series;

h.) determining a probability expectation value, with a probability expectation value analyzer 58 based on the spectral similarity;

i.) generating a probability operand, with a probability operand generator 60 having a value selected from a set of zero and one, based on the probability expectation value;

j.) repeating steps b-i until the probability operand has a value of one as determined by the processor 42;

k.) storing the summed Fourier series to an intermediate memory section 62;

l.) removing the selected filters from the selected set of filters 52 to form an updated set of filters 52;

m.) removing the subsets from the string to obtain an updated string;

n.) selecting an updated filter 64 from the updated set of filters;

o.) sampling the updated string with the updated filter to form a sampled Fourier series comprising a subset of the string;

p.) modulating the sampled Fourier series in Fourier space with the corresponding selected updated filter to form an updated order formatted Fourier series;

q.) recalling the summed Fourier series from the intermediate memory section 62;

r.) adding the updated order formatted Fourier series to the summed Fourier series from the intermediate memory section to form an updated summed Fourier series in Fourier space;

s.) obtaining another ordered Fourier series from the High Level Memory section 54;

t.) determining a spectral similarity between the updated summed Fourier series and the another ordered Fourier series;

u.) determining a probability expectation value based on the spectral similarity;

v.) generating a probability operand having a value selected from a set of zero and one, based on the probability expectation value;

w.) repeating steps n-v until the probability operand has a value of one or all of the updated filters have been selected from the updated set of filters as determined by processor 42;

x.) if all of the updated filters have been selected before the probability operand has a value of one, then clearing the intermediate memory section and returning to step b;

y.) if the probability operand has a value of one, then clearing the intermediate memory section and storing the updated summed Fourier series to the intermediate memory section;

z.) repeating steps l-y until the one of the following set of conditions is satisfied: the updated set of filters is empty, or the remaining subsets of the string of step m.) is nil as determined by the processor 42;

aa.) storing the Fourier series of intermediate memory section to the High Level Memory section 54.

Each filter of the set of filters can be a time delayed Gaussian filter having a half-width parameter $\alpha$ which determines the amount of the string that is sampled. Each filter of the set of filters can be a time delayed Gaussian filter having a delay parameter $\frac{\sqrt{N}}{\alpha}$ which corresponds to a time point. Each Fourier series of the ordered string can be multiplied by the Fourier transform of the delayed Gaussian filter represented by $e^{-\frac{1}{2}\left(v_{s\rho 0}\frac{k_\rho}{\alpha_{s\rho 0}}\right)^2} e^{-j\frac{\sqrt{N_{s\rho 0}}}{\alpha_{s\rho 0}}(v_{s\rho 0}k_\rho)} e^{-\frac{1}{2}\left(v_{sz0}\frac{k_z}{\alpha_{sz0}}\right)^2} e^{-j\frac{\sqrt{N_{sz0}}}{\alpha_{sz0}}(v_{sz0}k_z)}$. The filter established the correct order. The ordered string can be represented by:

$$\sum_{s=1}^{S}\sum_{m=1}^{M_s}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}} a_{0_{s,m}} N_{s,m_{\rho_0}} N_{s,m_{z_0}} e^{-\frac{1}{2}\left(v_{s\rho 0}\frac{k_\rho}{\alpha_{s\rho 0}}\right)^2} e^{-j\frac{\sqrt{N_{s\rho 0}}}{\alpha_{s\rho 0}}(v_{s\rho 0}k_\rho)} e^{-\frac{1}{2}\left(v_{sz0}\frac{k_z}{\alpha_{sz0}}\right)^2} e^{-j\frac{\sqrt{N_{sz0}}}{\alpha_{sz0}}(v_{sz0}k_z)}$$

$$e^{-jk_\rho\left(\rho_{fbs,m}+\rho_{ts,m}\right)}\sin\left(\left(k_\rho - n\frac{2\pi}{\rho_{0_{s,m}}}\right)\frac{N_{s,m_{\rho 0}}\rho_{0_{s,m}}}{2}\right)\sin\left(\left(k_z - n\frac{2\pi}{v_{s,m}t_{0_{s,m}}}\right)\frac{N_{s,m_{z0}}z_{0_{s,m}}}{2}\right)$$

wherein $v_{s\rho 0}$ and $v_{sz0}$ are constants such as the signal propagation velocities in the $\rho$ and $z$ directions, respectively, $\frac{\sqrt{N_{s\rho 0}}}{\alpha_{s\rho 0}}$ and $\frac{\sqrt{N_{sz0}}}{\alpha_{sz0}}$ are delay parameters and $\alpha_{s\rho 0}$ and $\alpha_{sz0}$ are half-width parameters of a corresponding Gaussian filter in the $\rho$ and $z$ directions, respectively, $\rho_{t_{s,m}} = v_{t_{s,m}}t_{t_{s,m}}$ is the modulation factor which corresponds to the physical time delay $t_{t_{s,m}}$, $\rho_{fbs_{s,m}} = v_{fbs_{s,m}}t_{fbs_{s,m}}$ is the modulation factor which corresponds to the specific transducer time delay $t_{fbs_{s,m}}$, $v_{t_{s,m}}$ and $v_{fbs_{s,m}}$ are constants such as the signal propagation velocities, $a_{0_{s,m}}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, $s$, $M_s$, and $S$ are integers, and $N_{s,m_{\rho_0}}$, $N_{s,m_{z_0}}$, $\rho_{0_{s,m}}$, and $z_{0_{s,m}}$ are data parameters. The data parameters are selected in the same manner as described above.

The probability expectation value may be based upon Poissonian probability. The probability expectation value is represented by

$$\prod_s\left[p_{\uparrow_s} + \left(P - p_{\uparrow_s}\right)\exp\left[-\beta_s^{-2}\left(\frac{1-\cos 2\phi_s}{2}\right)\right]\cos\left(\delta_s + 2\sin\phi_s\right)\right]$$

wherein $P$ is the maximum probability of at least one other Fourier series being associated with a first Fourier series, $p_{\uparrow_s}$ is a probability of at least one other Fourier series being associated with a first Fourier series in the

absence of coupling of the first Fourier series with the at least one other Fourier series, $\beta_s^2$ is a number that represents the amplitude of spectral similarity between at least two filtered or unfiltered Fourier series, $\phi_s$ represents the frequency difference angle between at least two filtered or unfiltered Fourier series, and $\delta_s$, is a phase factor. $\beta_s^2$ may be characterized by

$$\beta_s^2 = (8\pi)^2 \frac{1}{\sqrt{2\pi}} \sqrt{\frac{\alpha_1^2\alpha_s^2}{\alpha_1^2+\alpha_s^2} \sum_{m_1=1}^{M_1} a_{0_{m_1}} N_{m_1} \sum_{m_s=1}^{M_s} a_{0_{m_s}} N_{m_s}}$$

$$\exp-\left\{ \frac{\frac{\alpha_1^2\alpha_s^2}{\alpha_1^2+\alpha_s^2}\left(\frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \left(\frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} + \frac{\rho_{fb_{m_1}}}{v_{fb_{m_1}}} + \frac{\rho_{t_{m_1}}}{v_{t_{m_1}}}\right) - \left(\frac{N_{m_s}\rho_{0_{m_s}}}{2v_{m_s}} + \frac{\rho_{fb_{m_s}}}{v_{fb_{m_s}}} + \frac{\rho_{t_{m_s}}}{v_{t_{m_s}}}\right)\right)^2}{2} \right\}$$

wherein $\rho_{t_{m_1}} = v_{t_{m_1}} t_{t_{m_1}}$ and $\rho_{t_{m_s}} = v_{t_{m_s}} t_{t_{m_s}}$ are the modulation factors which corresponds to the physical time delays $t_{t_{m_1}}$ and $t_{t_{m_s}}$, respectively, $\rho_{fb_{m_1}} = v_{fb_{m_1}} t_{fb_{m_1}}$ and $\rho_{fb_{m_s}} = v_{fb_{m_s}} t_{fb_{m_s}}$ are the modulation factors which corresponds to the specific transducer time delay $t_{fb_{m_1}}$ and $t_{fb_{m_s}}$, respectively, $v_{t_{m_1}}$, $v_{t_{m_s}}$, $v_{fb_{m_1}}$, and $v_{fb_{m_s}}$ are constants such as the signal propagation velocities, $\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$ and $M_s$ are integers, $a_{0_{m_1}}$, $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above. $\phi_s$ may be represented by

$$\phi_s = \frac{\pi\left(\frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \sum_{m_1=1}^{M_1}\left(\frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} + \frac{\rho_{fb_{m_1}}}{v_{fb_{m_1}}} + \frac{\rho_{t_{m_1}}}{v_{t_{m_1}}}\right) - \sum_{m_s=1}^{M_s}\left(\frac{N_{m_s}\rho_{0_{m_s}}}{2v_{m_s}} + \frac{\rho_{fb_{m_s}}}{v_{fb_{m_s}}} + \frac{\rho_{t_{m_s}}}{v_{t_{m_s}}}\right)\right)}{\frac{\sqrt{N_1}}{\alpha_1} + \sum_{m_1=1}^{M_1}\left(\frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} + \frac{\rho_{fb_{m_1}}}{v_{fb_{m_1}}} + \frac{\rho_{t_{m_1}}}{v_{t_{m_1}}}\right)}$$

wherein $\rho_{t_{m_1}} = v_{t_{m_1}} t_{t_{m_1}}$ and $\rho_{t_{m_s}} = v_{t_{m_s}} t_{t_{m_s}}$ are the modulation factors which corresponds to the physical time delays $t_{t_{m_1}}$ and $t_{t_{m_s}}$, respectively, $\rho_{fb_{m_1}} = v_{fb_{m_1}} t_{fb_{m_1}}$ and $\rho_{fb_{m_s}} = v_{fb_{m_s}} t_{fb_{m_s}}$ are the modulation factors which

corresponds to the specific transducer time delay $t_{fb_{m_1}}$ and $t_{fb_{m_s}}$, respectively, $v_{t_{m_1}}$, $v_{t_{m_s}}$, $v_{fb_{m_1}}$, and $v_{fb_{m_s}}$ are constants such as the signal propagation velocities, $\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$, and $M_s$ are integers, $a_{0_{m_1}}$ and $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above.

The String Ordering Layer produces an ordered string of Fourier series, wherein the ordered string is stored in the High Level Memory section.

The output of an ordered string of Fourier series in Fourier space thus constitutes the recognition of a pattern in the processed information. This clear disclosure, once again, shows that the Examiner's rejection of claims in this case is in error.

On page 16 of the Answer, the Examiner commits further error in arguing that:

> With regard to the above article in Engineering Applications of Artificial Intelligence, it does not support that the system can be really implemented in a practical world, because it may represent an abstract idea. An abstract idea is publishable, but not necessary patentable. The issues between the practical implementation and abstract idea are just those asked by the Examiner in the previous office action.

This argument is also misplaced. The journal *Engineering Applications of Artificial Intelligence* publishes engineering applications of artificial intelligence wherein the system must have real-world application to engineering. Such application to pattern recognition is reported in the article. Abstract ideas are not publishable and the Examiner provides no evidence to support his position.

With regard to "section b" on pages 4-7 of the Office Action mailed 12/21/06, the Examiner further argues on pages 16-17 of the Answer that:

> Appellant's argument --
>
> To respond to the issue, the Appellant referred to many parts of the specification as indicated in pages 46-4 7 to provide support of his teaching.

Examiner's response --

The **Appellant did not answer directly the specific question** related to the Examiner's conclusion: "After summation of FSs to form [formula in original] does not explicitly carry the index information of each FS, s, nor element m. As a consequence, no mathematical operation can be applied to each individual FC or each individual FS after a string is formed." Let us consider the equation shown in page 47 of the present Brief. The result of the summation is $V(k_p, k_z)$. Please note that $V(k_p, k_z)$ is a function $k_p$ and $k_z$ with possible being indexed by M.

For example, consider a measurement in which 3 (M=3) transducer elements are used to generate input data. For a first case, all the original data parameters Nmpo, Nmzo, Pom, zom are zero for all m=1, 2, and 3, where m is used to label data of transducer element m. So the summation of the equation $V(k_p, k_z) = 0$ for all $(k_p, k_z)$. Similarly, $V\Sigma m(k_p, k_z) = 0$. They are both functions of only $k_p$ and $k_z$.. Take another case, the original data parameters Nmpo, Nmzo Pom, Zom are zero for all m1 and 2 and are 1 for m=3. Then $V\Sigma m(k_p, k_z)$ will have the form as:

$$V_{\Sigma_m}(k_p, k_z) = \sum_{n=-\infty}^{\infty} \frac{4\pi}{1+\frac{k_z^2}{k_p^2}} a_{o3} \sin((k_p - n2\pi)) \sin((k_z - n2\pi))$$

Clearly, $V\Sigma m(k_p, k_z)$ has no information of Nmpo, Nmzo Pom, zom in the above equation.

Appellant responded directly to the Examiner's question, but the Examiner persists in focusing on support material and not the disclosed and claimed invention, which are in some cases different. The claims are based on the disclosure given primarily on pages 1 through 24 in the Application. Appellant provides sub-appendices to disclose the background of the invention that are meant as support. The equation to which the Examiner refers is the Fourier transform of a finite train of voltage pulses. It is not the Fourier series in Fourier space parameterized by data, which is one aspect of the current Invention.

On pages 17-18 of the Answer, the Examiner commits further error in arguing that:

> Claim 51 recites a limitation of "modulating said sampled Fourier series in Fourier space with said filter to form a modulated Fourier series". The Appellant provided an exemplary string with a characteristic modulation having a frequency within the band, related to this limitation, in page 15 of the specification. As discussed above, the sampled Fourier series is a function of only $k_p$, $k_z$, it does not keep record of data parameters Nmpo, Nmzo Pom, zom. As shown in the equation in page *15,* the exponential terms are related to the modulating function. They are related to information about data parameters Nmpo, Nmzo, po, zo, because the exponential term is indexed with m. **As explained above, after summation of FSs to form** $V\Sigma s,m(k_p, k_z)$, $V\Sigma m(k_p, k_z)$**, or** $V(k_p, k_z)$, **the sampled Fourier series does not carry the index information of element m. How can one apply the modulating of the equation in page 15 of the specification?** The Examiner never questions how equation in page *15* of the specification can be carried out when all data parameters Nmpo, Nmzo Pom, Zom are still known. The Examiner questioned how the **equation can be carried out on the sampled Fourier series without indexed to m, and without** Nmpo, Nmzo, Pom, **zom to carry out the subsequent sampling and modulating process for producing subsequent strings because the series has lost the needed information for computation.**

This aspect of the Examiner's Final Rejection is also erroneous. The Examiner improperly applies old ideas about Fourier representations of signals to the present invention. The concepts disclosed by Appellant are totally different. The Fourier series in Fourier space parameterized with the data is **NOT** equivalent to the Fourier transform a voltage versus time signal for the example that the Examiner identifies with. The identity of the data can reside with the memory location in one specific embodiment as disclosed on page 7, line 35 to page 11, line 17.

On page 18 of the Answer, the Examiner again erroneously argues that:

> With regard to questions (l)-(3) in pages 6-7 of the previous office action, Appellant again did not answer the question. As Explained above, after the formation of Fourier series, the parameters Nm1, Pom1, Nm2, Pom2 are not preserved.

Appellant submits that they <u>are</u> preserved in the memory structure in one embodiment, as disclosed in the originally filed application.

On page 18 of the Answer, the Examiner asks the question:

How can one perform any calculation based on the parameters Nm1, Pom1, Nm2, Pom2?

The answer is simple: In one embodiment, the "calculation" is the determination of spectral similarity between two or more Fourier series in Fourier space. One method that gives the Fourier series in Fourier space parameterized by the data and the corresponding equations for determination of the spectral similarity is disclosed on page 13, line 1 to page 15, line 8. In this case, the data parameters from memory are simply taken from their specific memory locations and plugged into the equations according to the data structure and corresponding to the designations in equations as given below.

> Referring again to Figure 2, several parameterized Fourier components are input to the Association Layer to form associations of the Fourier series. The Fourier components may be stored in a Fourier component section 30 of a temporary memory section 28. The Fourier components are added to form multiple Fourier series which in turn may be stored in a Fourier series section 32 of the temporary memory section 28. At least one of the Fourier series stored in the Fourier series section 32 is input to a filter 34 wherein the filter 34 samples and modulates the Fourier series. The filtered Fourier series is input to a spectral similarity analyzer 36. The spectral similarity analyzer 36 determines the spectral similarity between the filtered Fourier series and another Fourier series stored in the Fourier series section 32 of the temporary memory section 28. A spectral similarity value is output from the spectral similarity analyzer 36 and input to a probability expectation analyzer 38. The probability expectation analyzer 38 determines a probability expectation value based on the spectral similarity value. The probability expectation value output from the probability expectation analyzer 38 is input to a probability operand generator 40. The probability operand generator 40 generates a probability operand value of one or zero based upon the probability expectation value. The probability operand value is output to a processor 42. If the probability operand value is zero, the processor 42 sends another Fourier series from the Fourier series section 32 of the temporary memory section 28 to the filter 34 and begins the process again. If the probability operand value is one, the filtered Fourier series and the other Fourier series are added to form a string and the string is stored in a string memory section 44.
>
> The filter 34 can be a time delayed Gaussian filter in the time domain. The filter may be characterized in time by:
>
> $$\frac{\alpha}{\sqrt{2\pi}} e^{\frac{\left(t-\frac{\sqrt{N}}{\alpha}\right)^2}{\frac{2}{\alpha^2}}}$$

wherein $\frac{\sqrt{N}}{\alpha}$ is a delay parameter, $\alpha$ is a half-width parameter, and $t$ is the time parameter. The Gaussian filter may comprise a plurality of cascaded stages each stage having a decaying exponential system function between stages. The filter, in frequency space, can be characterized by:

$$e^{-\frac{1}{2}\left(\frac{2\pi f}{\alpha}\right)^2} e^{-j\sqrt{N}\left(\frac{2\pi f}{\alpha}\right)}$$

wherein $\frac{\sqrt{N}}{\alpha}$ and $\alpha$ are a corresponding delay parameter and a half-width parameter in time, respectively, and $f$ is the frequency parameter. The probability distribution may be Poissonian. Thus, the probability expectation value can be based upon Poissonian probability. The probability expectation value may be characterized by

$$\prod_s \left[p_{\uparrow_s} + \left(P - p_{\uparrow_s}\right)\exp\left[-\beta_s^{-2}\left(\frac{1-\cos 2\phi_s}{2}\right)\right]\cos\left(\delta_s + 2\sin\phi_s\right)\right]$$

wherein $P$ is the maximum probability of at least one other Fourier series being associated with a first Fourier series, $p_{\uparrow_s}$ is a probability of at least one other Fourier series being associated with a first Fourier series in the absence of coupling of the first Fourier series with the at least one other Fourier series, $\beta_s^2$ is a number that represents the amplitude of spectral similarity between at least two filtered or unfiltered Fourier series, $\phi_s$ represents the frequency difference angle between at least two filtered or unfiltered Fourier series, and $\delta_s$, is a phase factor. $\beta_s^2$ may be characterized by

$$\beta_s^2 = (8\pi)^2 \frac{1}{\sqrt{2\pi}} \sqrt{\frac{\alpha_1^2\alpha_s^2}{\alpha_1^2+\alpha_s^2}}$$

$$\sum_{m_1=1}^{M_1} a_{0_{m_1}} N_{m_1} \sum_{m_s=1}^{M_s} a_{0_{m_s}} N_{m_s} \exp - \left\{ \frac{\frac{\alpha_1^2\alpha_s^2}{\alpha_1^2+\alpha_s^2}\left(\frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} - \frac{N_{m_s}\rho_{0_{m_s}}}{2v_{m_s}}\right)^2}{2} \right\}$$

$\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$ and $M_s$ are integers, $a_{0_{m_1}}$ and $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above. $\phi_s$ may be characterized by

$$\phi_s = \frac{\pi\left(\frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \sum_{m_1=1}^{M_1} \frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} - \sum_{m_s=1}^{M_s} \frac{N_{m_s}\rho_{0_{m_s}}}{2v_{m_s}}\right)}{\frac{\sqrt{N_1}}{\alpha_1} + \sum_{m_1=1}^{M_1} \frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}}}$$

$\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$ and $M_s$ are integers, $a_{0_{m_1}}$ and $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above.

On page 18 of the Answer, the Examiner argues that:

> For example, all the information on the right hand side of the second equation in Fig. 2 IA is not preserved after summation.

Again, the Examiner improperly refers to a conventional Fourier transform of a finite train of voltage pulses that is background material, and not the claimed invention (a Fourier series in Fourier space).

On page 18 of the Answer, the Examiner further argues that:

> [A]ll the information on the right hand side of the second equation in Fig. 21A is not preserved after summation. Without the information of the infinite terms on the right hand side of the second equation in Fig. 21 A available, how can one perform the right hand side of the third second equation in Fig. 2 1A to recall a Fourier series? How can one perform the Association computation according to the equation in page 16? And How can one calculate the probability expectation value based on the equation in line 7, of page 14 and in Fig. 21B?

Here again, the Examiner's questions are easily answered. In one embodiment, the performance of the Association computation according to the equation on page 16 and the means by which one calculates the probability expectation value based on the equation on line 7, page 14 is achieved by taking the data parameters from memory at their specific memory locations and plugging them into the equations as designated. The background equation of Fig. 21B is to be DISTINQUISHED from the referenced

equation in page 16 and the equation in line 7, page 14. It is merely a conventional Fourier transform a finite voltage train and is not a Fourier series in Fourier space parameterized with the data.

With regard to the rejection of claims 51-322 under 35 U.S.C. 101, because they are allegedly non-operational and do not have utility, the Examiner argues on pages 18-19 of the Answer that:

> Appellant's argument --
>
> In page 9 of the previous office action, the Examiner concluded that Equation (3) of the present specification cannot produce the needed delay. Therefore, it makes the invention non-operational. To respond to the conclusion, the Appellant discussed in pages 53-61 of the Brief how the delay can be produced. (1) Appellant submits that the Examiner is confused on several points. There is no multiplication by a factor $e^{j2\pi f}$ in Eqs. (2) and (3). This is simply a constant complex number. (2) Furthermore, Appellant respectfully submits that the Examiner is confused about the range of f since it is not two exact frequencies –f0 and f0. Rather, it is a free running variable in Fourier space. Similarly, kp and kz are free running variables in Fourier space. The data parameters modify these variables in the modulation factor and in the Fourier-term.
>
> Examiner's response --
>
> How one delay a signal X(t) with multiplying each Fourier with phase factors is explained below. First let us Fourier transform X(t) as shown in equation (a) below;
>
> $$X(t) = S\, a(f)\, e^{j2\pi ft}\, df \qquad \text{(a)}$$
>
> X(t) can be delayed by amount T with multiplying each Fourier component $e^{j2\pi ft}$ in Eq. (a) with e -j2πfT as below.
>
> $$X'(t) = S\ a(f)\, e^{j2\pi ft}\, e^{-j2\pi fT}\, df = S\, a(f')\, e^{j2\pi f(t-T)}\, df \qquad \text{(b)}$$
>
> If we rewrite t' = t-T, then
>
> $$t=t'+T \qquad \text{(c)}$$
>
> Substituting Eq. (c) into Eq.(b), we get

$X'(t'+T) = S\ a(f)\ e^{j2\pi ft'}\ df$

(d)

> The right hand sides of Eqs. (a) and (d) are of the same form. It indicates that X(t) has the same value as X'(t'+T), namely X(0) = X'(T), and X(1) = X'(1+T). X' is a delayed version of X. The key point for the delaying with time T to work is for each frequency f to multiply $e^{j2\pi ft}$ with an exponential term with a phase factor given by $2\pi fT$ such as $e^{j2\pi fT}$. **That means that phase** factor is proportional to the frequency f as fT.

Regarding conventional Fourier transforms, Appellant agrees that the multiplication of each Fourier component by a factor $e^{-j2\pi t_0}$ wherein $t_0$ is a CONSTANT is equivalent to the convolution in the time domain with $\delta(t-t_0)$ which corresponds to the time delay by $t_0$. Alternatively, the Fourier transform of a function $x(t)$ with a time delay $t_0$ is $e^{-j2\pi ft_0}X(f)$ [Siebert, W. McC., Circuits, Signals, and Systems, The MIT Press, Cambridge, Massachusetts, (1986), p. 416]]. This is disclosed in the application for example on p. 11 line 18 to line 25:

> In one embodiment, the characteristic modulation having a frequency within the band in Fourier space is represented by $e^{-j2\pi ft_0}$. The modulation corresponds to the time delay $\delta(t-t_0)$ wherein $f$ is the frequency variable, $t$ is the time variable, and $t_0$ is the time delay. The characteristic modulation is encoded as a delay in time by storing the Fourier series in a specific portion of the Input Layer section of the memory wherein the specific portion has $n+1$ sub time intervals. Each sub time interval corresponds to a frequency band.

Then, the modulation factor $e^{-j2\pi ft_0}$ is a function of frequency as well as the value of the data parameter $t_0$ as disclosed. A phase is a constant in the argument of the complex exponential; whereas, Appellant is multiplying two or more complex exponentials or trigonometric functions having variables $f$ weighted by the data parameters $t_0$ where there is a unique $t_0$ to encode the context of the corresponding data parameters of a set, in an embodiment. Multiplication of two or more trigonometric functions with continuous variables weighted by selected constants is classic modulation as given in Chp 17 of McC. Siebert [Siebert, W. McC., Circuits, Signals, and

Systems, The MIT Press, Cambridge, Massachusetts, (1986)]. It is not equivalent to a constant phase factor in a trigonometric function.

On pages 19-20 of the Answer, the Examiner argues that:

> With regard to point (1) about, the $k_p$ used in the exponential term in Eq. (3) is not a constant. It varies with $k_p$ which is a frequency in the Fourier space defined by the Appellant. (See the definition below the equation in page 8 of the present specification.)

Appellant agrees that $k_\rho$ and $k_z$ are the frequency variables. See page 11, line 25 to page 12, line 2 of the application, which states:

> In an alternative embodiment, the characteristic modulation, having a frequency within the band is represented by $e^{-jk_\rho(\rho_{fb_m}+\rho_{t_m})}$. Thus, the Fourier series in Fourier space may be:
>
> $$\sum_{m=1}^{M}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}a_{0_m}N_{m_{\rho_0}}N_{m_{z_0}}e^{-jk_\rho(\rho_{fb_m}+\rho_{t_m})}\sin\left(k_\rho\frac{N_{m_{\rho_0}}\rho_{0_m}}{2}-n\frac{2\pi N_{m_{\rho_0}}}{2}\right)\sin\left(k_z\frac{N_{m_{z_0}}z_{0_m}}{2}-n\frac{2\pi N_{m_{z_0}}}{2}\right)$$
>
> wherein $\rho_{t_m}=v_{t_m}t_{t_m}$ is the modulation factor which corresponds to the physical time delay $t_{t_m}$, $\rho_{fb_m}=v_{fb_m}t_{fb_m}$ is the modulation factor which corresponds to the specific transducer time delay $t_{fb_m}$, $v_{t_m}$ and $v_{fb_m}$ are constants such as the signal propagation velocities, $a_{0_m}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, and $M$ are integers, and $N_{m_{\rho_0}}$, $N_{m_{z_0}}$, $\rho_{0_m}$, and $z_{0_m}$ are data parameters. The data parameters are selected in the same manner as described above.

On page 20 of the Answer, the Examiner continues with his erroneous argument, claiming that:

> It is well known that sin (ft) = ($e^{jft}$ + $e^{-jft}$)/ (2j). So the first sine function in equation (3) above has two frequencies, a pair of positive and negative f. To make a delay by phase shifting in any Fourier space, no matter a traditional or the special one given by the Appellant, when $e^{jft}$ is multiplied by $e^{jfT}$, the term associated with $e^{-jft}$ is multiplied by $e^{-jfT}$. However, the exponential factor in front of the first "sin" corresponds only to one f, the positive frequency f. The Appellant admitted that he did not have the equation and arguing that the f0 is a free running variable. It does matter, the frequency is free running variable not. **The key is that they need to be multiplied simultaneous as a pair with opposite phase delay.**

Appellant is not creating a phase delay of the Fourier series in Fourier space. The factor $e^{-j2\pi f t_0}$ multiplies a function of OTHER VARIABLES and thus modulates the function. The **Examiner has again missed the point that the Fourier series in Fourier space is not an application of convention Fourier transforms**. It does not represent a transform of a continuous time signal such as a voltage at a detector. It is a formula that, in an embodiment, comprises a series of weighted sine and cosine terms and modulation factors parameterized with data parameters in a specified manner to allow two or more such data-parameterized constructs to be processed to determine spectra similarities in the constructs and then modify the data structure according to the outcome.

The disclosed data construct does give rise to a means to execute the determination of spectral similarity. In a specific embodiment, it corresponds to the executable equations given in the disclosure on page 13, line 27 to page 15, line 8 with background given in the Support Appendices:

> The filter 34 can be a time delayed Gaussian filter in the time domain. The filter may be characterized in time by:
>
> $$\frac{\alpha}{\sqrt{2\pi}} e^{\frac{\left(t-\frac{\sqrt{N}}{\alpha}\right)^2}{\frac{2}{\alpha^2}}}$$
>
> wherein $\frac{\sqrt{N}}{\alpha}$ is a delay parameter, $\alpha$ is a half-width parameter, and $t$ is the time parameter. The Gaussian filter may comprise a plurality of cascaded stages each stage having a decaying exponential system function between stages. The filter, in frequency space, can be characterized by:
>
> $$e^{-\frac{1}{2}\left(\frac{2\pi f}{\alpha}\right)^2} e^{-j\sqrt{N}\left(\frac{2\pi f}{\alpha}\right)}$$
>
> wherein $\frac{\sqrt{N}}{\alpha}$ and $\alpha$ are a corresponding delay parameter and a half-width parameter in time, respectively, and $f$ is the frequency parameter. The probability distribution may be Poissonian. Thus, the probability expectation value can be based upon Poissonian probability. The probability expectation value may be characterized by
>
> $$\prod_s \left[ p_{\uparrow_s} + \left(P - p_{\uparrow_s}\right) \exp\left[-\beta_s^{-2}\left(\frac{1-\cos 2\phi_s}{2}\right)\right] \cos\left(\delta_s + 2\sin\phi_s\right)\right]$$

wherein $P$ is the maximum probability of at least one other Fourier series being associated with a first Fourier series, $p_{\uparrow_s}$ is a probability of at least one other Fourier series being associated with a first Fourier series in the absence of coupling of the first Fourier series with the at least one other Fourier series, $\beta_s^2$ is a number that represents the amplitude of spectral similarity between at least two filtered or unfiltered Fourier series, $\phi_s$ represents the frequency difference angle between at least two filtered or unfiltered Fourier series, and $\delta_s$, is a phase factor. $\beta_s^2$ may be characterized by

$$\beta_s^2 = (8\pi)^2 \frac{1}{\sqrt{2\pi}} \sqrt{\frac{\alpha_1^2\alpha_s^2}{\alpha_1^2+\alpha_s^2}}$$

$$\sum_{m_1=1}^{M_1} a_{0_{m_1}} N_{m_1} \sum_{m_s=1}^{M_s} a_{0_{m_s}} N_{m_s} \exp -\left\{ \frac{\frac{\alpha_1^2\alpha_s^2}{\alpha_1^2+\alpha_s^2}\left(\frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} - \frac{N_{m_s}\rho_{0_{m_s}}}{2v_{m_s}}\right)^2}{2} \right\}$$

$\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$ and $M_s$ are integers, $a_{0_{m_1}}$ and $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above. $\phi_s$ may be characterized by

$$\phi_s = \frac{\pi\left(\frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \sum_{m_1=1}^{M_1} \frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} - \sum_{m_s=1}^{M_s} \frac{N_{m_s}\rho_{0_{m_s}}}{2v_{m_s}}\right)}{\frac{\sqrt{N_1}}{\alpha_1} + \sum_{m_1=1}^{M_1} \frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}}}$$

$\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$ and $M_s$ are integers, $a_{0_{m_1}}$ and $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above.

The Examiner's argument regarding the conventional Fourier transform of the sine function in time and a phase delay in frequency space does not apply to the claimed present invention since it is not based on the same. The Examiner is also incorrect in his misdirected application of the Fourier transform equation. The Examiner has erred in that frequency is the variable, not time. In the present invention, in an embodiment, the time parameters are data constants wherein each time t (designated $t_0$ in the application) is treated as a separate constant, such that $t - T \neq T$. Furthermore, the Examiner's equation is not representative of a phase shift, which has the form $e^{j(2\pi ft+T)}$ not $e^{j2\pi f(t-T)}$ wherein f is the variable.

On pages 20-21 of the Answer, the Examiner argues that:

> In the previous office action, the Examiner concluded that
>
> "Furthermore its multiplication factor for the proposed process for generating delay does not have the exact same frequency f Their frequencies are listed in the table below. The first sine function in equation (3) has a frequency depending on the data parameters, which are associated with the measured information that can vary from measurement to measurement."
>
> The Appellant did not respond to this conclusion. As pointed about, to delay a waveform, the frequencies of each of Fourier series associated with its corresponding coefficient cannot be changed in multiplying the phase factor $e^{-j2\pi fT}$. In the Appellant's special Fourier series in Fourier space shown in page 63 of the Brief, the frequency kp, is changed with parameters Nmpo, Nmzo, po, zo. As a consequence, the Appellant's teaching cannot produce the needed delay for implementing the method. More specifically, take the equation in page 15 of the specification for consideration. The first sin term has a frequency of *kp* (Ns,mpo Ps,m)/2. For this term the phase factor is given in the exponential term having a frequency kp. As taught in the specification, the frequency of kp (Ns,mpo Ps,m)/2 changes with measured parameters. The delay depends not only on the transducer elements, but also depends on the measured data. For the first case discussed above in which all the original data parameters Nmpo, Nmzo, Pom, zom are zero for all m=1, 2, and 3, the frequency of *kp*(Ns, mpo Ps,m)/2 is zero for all m=l ,3. For the second case discussed above in which the original data parameters Nmpo, Nmzo, Pom, Zom are zero for all m=1 and 2 and are 1 for m=3, the frequency of kp (Ns,mpo Ps,m)/2 is zero for all m=1 and 2, but is kp/2 for m=3. Data of the same element m=3 is delayed differently and the corresponding memory

address for m=3 cannot be correctly defined. The data retrieval will be just random and not meaningful.

Those arguments are also misplaced. Appellant is not delaying a waveform in the traditional sense of a conventional Fourier series. In an embodiment, a Fourier series in Fourier space that is parameterized with data is modulated by frequency functions also parameterized with data, wherein each modulation function is mathematically equivalent to a corresponding delay in time. This is disclosed in the application, for example on page 11, lines 18-25:

> In one embodiment, the characteristic modulation having a frequency within the band in Fourier space is represented by $e^{-j2\pi f t_0}$. The modulation corresponds to the time delay $\delta(t-t_0)$ wherein $f$ is the frequency variable, $t$ is the time variable, and $t_0$ is the time delay. The characteristic modulation is encoded as a delay in time by storing the Fourier series in a specific portion of the Input Layer section of the memory wherein the specific portion has $n+1$ sub time intervals. Each sub time interval corresponds to a frequency band.

Furthermore, the data retrieval is not random and has utility to determine spectral similarity and to recognize a pattern in embodiments. The retrieval data structure is disclosed at page 7, line 35 to page 12, line 2 of the application:

> The following example illustrates how the present invention processes the physical characteristics of an item of interest, specifically a triangle. In flat geometry, the physical characteristics of a triangle are three connected lines at angles aggregating to 180°. The physical characteristics provide spatial variations of light scattering. In one embodiment, a light responsive transducer (not shown) of the system 10 transduces the light scattering into the data. An exemplary transducer is a charge coupled device ("CCD") array. One data element at a point in time may be a voltage of a particular CCD element of the CCD array. Each CCD element of the CCD array has a spatial identity. The physical context for the triangle is the relationship of the lines at the corresponding angles providing a spatial variation of light scattering. The input context is the identity of each CCD element that responds according to the physical context. For example, a CCD element (100,13) of a 512 by 512 CCD array will uniquely respond to light scattered by the lines and angular relations of the triangle relative to the other CCD elements of the CCD array. The response is stored in a specific memory register of an Input Layer section of the memory 20. The specific memory register is reflective of the input context. In the present invention, a Fourier series in Fourier

space represents the information of the triangle parameterized according to the voltage and the CCD element identity.

Referring to FIGURE 2, in the first step, the Input Layer 12 receives the data from the transducer (not shown). A Fourier transform processor 22 encodes each data element as parameters of a Fourier component in Fourier space and stores the data parameter values to the Input Layer section 24 of the memory 20. Each Fourier component of the Fourier series may comprise a quantized amplitude, frequency, and phase angle. For example the Fourier series in Fourier space may be:

$$\sum_{m=1}^{M}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}a_{0_m}N_{m_{\rho_0}}N_{m_{z_0}}\sin\left(\left(k_\rho-n\frac{2\pi}{\rho_{0_m}}\right)\frac{N_{m_{\rho_0}}\rho_{0_m}}{2}\right)\sin\left(\left(k_z-n\frac{2\pi}{z_{0_m}}\right)\frac{N_{m_{z_0}}z_{0_m}}{2}\right)$$

having a quantized amplitude, frequency, and phase angle, wherein $a_{0_m}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, and $M$ are integers, and $N_{m_{\rho_0}}$, $N_{m_{z_0}}$, $\rho_{0_m}$, and $z_{0_m}$ are the data parameters.

In a first embodiment, the data parameters $N_{m_{\rho_0}}$ and $N_{m_{z_0}}$ of the Fourier series component are proportional to the rate of change of the physical characteristic. Each of the data parameters $\rho_{0_m}$ and $z_{0_m}$ of each Fourier component is inversely proportional to the amplitude of the physical characteristic. In the triangle example, the amplitude of the voltage at a given CCD element relative to the neighboring CCD element defines the rate of change of the voltage which is converted into the data parameters $N_{m_{\rho_0}}$ and $N_{m_{z_0}}$. The inverse of the amplitude of the voltage of each CCD element is converted into the data parameters $\rho_{0_m}$ and $z_{0_m}$. As illustrated in FIGURE 3 and described above, for each CCD element, the Fourier series, parameterized accordingly, are stored to a specific sub register 27 of a specific register 26 of the Input Layer section 24 of the memory 20. Since the structure of a Fourier series is known in the art, only the parameters need to be stored in a digital embodiment.

The number and types of transducers that may supply information to the system is only limited by available technology, hardware and economics, as is the number $m$ of corresponding registers 26 for each transducer. Each register 26 may have any number $d$ of subregisters 27, where the number $d$ of subregisters of one register 26 is not necessarily the same as other registers 26. For example, "Level 1 " register "1 " may have thirty "Level 2 " subregisters 27 and "Level 1 " register "2 " may have one-hundred subregisters 27. Furthermore, each "Level 2 " register may have any number $e$ of subregisters, where the number $e$ of subregisters of one register 27 is not necessarily the same as other registers 27. For example, "Level 2 " register "1 " may have fifty "Level $n$" subregisters 29 and "Level 2 " register "2 " may have seventy "Level $n$" subregisters 29. Still further, each "Level $n$" register 29 may have any number $f$ of time

buffer elements 31, where the number $f$ of time buffer elements 31 is not necessarily the same as other time buffer elements 31.

In a second embodiment, each of the data parameters $N_{m_{\rho_0}}$ and $N_{m_{z_0}}$ of the Fourier series component is proportional to the amplitude of the physical characteristic. Each of the data parameters $\rho_{0_m}$ and $z_{0_m}$ of each Fourier component is inversely proportional to the rate of change of the physical characteristic. As in the first embodiment, for each CCD element, these parameters are stored in a specific sub register of the Input Layer section of the memory.

In a third embodiment, each of the data parameters $N_{m_{\rho_0}}$ and $N_{m_{z_0}}$ of the Fourier series component is proportional to the duration of the signal response of each transducer. Each of the data parameters $\rho_{0_m}$ and $z_{0_m}$ of each Fourier component is inversely proportional to the physical characteristic. As in the first embodiment, for each CCD element, these parameters are stored in a specific sub register of the Input Layer section of the memory.

As an alternative example, the Fourier series in Fourier space may be:

$$\sum_{m=1}^{M}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}\frac{4}{\rho_{0_m}z_{0_m}}a_{0_m}\sin\left(\left(k_\rho-n\frac{2\pi}{\rho_{0_m}}\right)\frac{N_{m_{\rho_0}}\rho_{0_m}}{2}\right)\sin\left(\left(k_z-n\frac{2\pi}{z_{0_m}}\right)\frac{N_{m_{z_0}}z_{0_m}}{2}\right)$$

having a quantized frequency, and phase angle, wherein $a_{0_m}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, and $M$ are integers, and $N_{m_{\rho_0}}$, $N_{m_{z_0}}$, $\rho_{0_m}$, and $z_{0_m}$ are the data parameters. As described with respect to the previous example, for each CCD element, these parameters are stored in a specific sub register of the Input Layer section of the memory.

The physical context is conserved by mapping with a one to one basis between the physical context and the input context based on the identity of each transducer. The input context is conserved by mapping on a one to one basis to the Input Layer section 24 of memory 20. In an embodiment, the input context is encoded in time as a characteristic modulation frequency band in Fourier space of the Fourier series. The characteristic modulation frequency band in Fourier space represents the input context according to the identity of a specific transducer of the relationship of two transducer elements. The modulation within each frequency band may encode not only input context but context in a general sense. The general context may encode temporal order, cause and effect relationships, size order, intensity order, before-after order, top-bottom order, left-right order, etc. all of which are relative to the transducer.

Still referring to FIGURE 3, the transducer has $n$ levels of subcomponents. Each transducer is assigned a portion 26 of the Input Layer section 24 of the memory 20. The memory 20 is arranged in a hierarchical manner. Specifically, the memory is divided and assigned to correspond to a master time interval with $n+1$ sub time intervals. The hierarchy parallels the $n$ levels of the transducer subcomponents. The $n$ th level transducer sub component provides a data stream to the system 10. The data stream is recorded as a function of time in the $n+1$ sub time interval. The time intervals represent time delays which correspond to the characteristic modulation frequency band in Fourier space which in turn represents the input context according to the specific transducer or transducer subcomponent.

An exemplary complex transducer which may be represented by a data structure comprising a hierarchical set of time delay intervals is a CCD array of a video camera comprising a multitude of charge coupled devices (CCDs). Each CCD comprises a transducer element and is responsive to light intensity of a given wavelength band at a given spatial location in a grid. Another example of a transducer is an audio recorder comprising transducer elements each responsive to sound intensity of a given frequency band at a given spatial location or orientation. A signal within the band 300-400 MHz may encode and identify the signal as a video signal; whereas, a signal within the band 500-600 MHz may encode and identify the signal as an audio signal. Furthermore, a video signal within the band 315-325 MHz may encode and identify the signal as a video signal as a function of time of CCD element (100,13) of a 512 by 512 array of CCDs.

In one embodiment, the characteristic modulation having a frequency within the band in Fourier space is represented by $e^{-j2\pi f t_0}$. The modulation corresponds to the time delay $\delta(t-t_0)$ wherein $f$ is the frequency variable, $t$ is the time variable, and $t_0$ is the time delay. The characteristic modulation is encoded as a delay in time by storing the Fourier series in a specific portion of the Input Layer section of the memory wherein the specific portion has $n+1$ sub time intervals. Each sub time interval corresponds to a frequency band.

In an alternative embodiment, the characteristic modulation, having a frequency within the band is represented by $e^{-jk_\rho(\rho_{fb_m}+\rho_{t_m})}$. Thus, the Fourier series in Fourier space may be:

$$\sum_{m=1}^{M}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}a_{0_m}N_{m_{\rho_0}}N_{m_{z_0}}e^{-jk_\rho(\rho_{fb_m}+\rho_{t_m})}\sin\left(k_\rho\frac{N_{m_{\rho0}}\rho_{0_m}}{2}-n\frac{2\pi N_{m_{\rho0}}}{2}\right)\sin\left(k_z\frac{N_{m_{z0}}z_{0_m}}{2}-n\frac{2\pi N_{m_{z0}}}{2}\right)$$

wherein $\rho_{t_m}=v_{t_m}t_{t_m}$ is the modulation factor which corresponds to the physical time delay $t_{t_m}$, $\rho_{fb_m}=v_{fb_m}t_{fb_m}$ is the modulation factor which corresponds to the specific transducer time delay $t_{fb_m}$, $v_{t_m}$ and $v_{fb_m}$ are

constants such as the signal propagation velocities, $a_{0_m}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, and $M$ are integers, and $N_{m_{\rho_0}}$, $N_{m_{z_0}}$, $\rho_{0_m}$, and $z_{0_m}$ are data parameters. The data parameters are selected in the same manner as described above.

A method of using the data structure to recognize a pattern in information stored as data parameters is described on page 13, line 1 to page 16, line 12 of the application:

> Referring again to Figure 2, several parameterized Fourier components are input to the Association Layer to form associations of the Fourier series. The Fourier components may be stored in a Fourier component section 30 of a temporary memory section 28. The Fourier components are added to form multiple Fourier series which in turn may be stored in a Fourier series section 32 of the temporary memory section 28. At least one of the Fourier series stored in the Fourier series section 32 is input to a filter 34 wherein the filter 34 samples and modulates the Fourier series. The filtered Fourier series is input to a spectral similarity analyzer 36. The spectral similarity analyzer 36 determines the spectral similarity between the filtered Fourier series and another Fourier series stored in the Fourier series section 32 of the temporary memory section 28. A spectral similarity value is output from the spectral similarity analyzer 36 and input to a probability expectation analyzer 38. The probability expectation analyzer 38 determines a probability expectation value based on the spectral similarity value. The probability expectation value output from the probability expectation analyzer 38 is input to a probability operand generator 40. The probability operand generator 40 generates a probability operand value of one or zero based upon the probability expectation value. The probability operand value is output to a processor 42. If the probability operand value is zero, the processor 42 sends another Fourier series from the Fourier series section 32 of the temporary memory section 28 to the filter 34 and begins the process again. If the probability operand value is one, the filtered Fourier series and the other Fourier series are added to form a string and the string is stored in a string memory section 44.
>
> The filter 34 can be a time delayed Gaussian filter in the time domain. The filter may be characterized in time by:
>
> $$\frac{\alpha}{\sqrt{2}\pi} e^{\frac{-\left(t-\frac{\sqrt{N}}{\alpha}\right)^2}{\frac{2}{\alpha^2}}}$$

wherein $\frac{\sqrt{N}}{\alpha}$ is a delay parameter, $\alpha$ is a half-width parameter, and $t$ is the time parameter. The Gaussian filter may comprise a plurality of cascaded stages each stage having a decaying exponential system function between stages. The filter, in frequency space, can be characterized by:

$$e^{-\frac{1}{2}\left(\frac{2\pi f}{\alpha}\right)^2} e^{-j\sqrt{N}\left(\frac{2\pi f}{\alpha}\right)}$$

wherein $\frac{\sqrt{N}}{\alpha}$ and $\alpha$ are a corresponding delay parameter and a half-width parameter in time, respectively, and $f$ is the frequency parameter. The probability distribution may be Poissonian. Thus, the probability expectation value can be based upon Poissonian probability. The probability expectation value may be characterized by

$$\prod_s \left[ p_{\uparrow_s} + \left(P - p_{\uparrow_s}\right) \exp\left[-\beta_s^{-2}\left(\frac{1-\cos 2\phi_s}{2}\right)\right] \cos(\delta_s + 2\sin\phi_s)\right]$$

wherein $P$ is the maximum probability of at least one other Fourier series being associated with a first Fourier series, $p_{\uparrow_s}$ is a probability of at least one other Fourier series being associated with a first Fourier series in the absence of coupling of the first Fourier series with the at least one other Fourier series, $\beta_s^2$ is a number that represents the amplitude of spectral similarity between at least two filtered or unfiltered Fourier series, $\phi_s$ represents the frequency difference angle between at least two filtered or unfiltered Fourier series, and $\delta_s$, is a phase factor. $\beta_s^2$ may be characterized by

$$\beta_s^2 = (8\pi)^2 \frac{1}{\sqrt{2\pi}} \sqrt{\frac{\alpha_1^2 \alpha_s^2}{\alpha_1^2 + \alpha_s^2}}$$

$$\sum_{m_1=1}^{M_1} a_{0_{m_1}} N_{m_1} \sum_{m_s=1}^{M_s} a_{0_{m_s}} N_{m_s} \exp-\left\{ \frac{\frac{\alpha_1^2 \alpha_s^2}{\alpha_1^2 + \alpha_s^2} \left( \frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} - \frac{N_{m_s}\rho_{0_{m_s}}}{2v_{m_s}} \right)^2}{2} \right\}$$

$\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$ and $M_s$ are integers, $a_{0_{m_1}}$ and $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above. $\phi_s$ may be characterized by

$$\phi_s = \frac{\pi\left(\frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \sum_{m_1=1}^{M_1} \frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} - \sum_{m_s=1}^{M_s} \frac{N_{m_s}\rho_{0_{m_s}}}{2v_{m_s}}\right)}{\frac{\sqrt{N_1}}{\alpha_1} + \sum_{m_1=1}^{M_1} \frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}}}$$

$\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$ and $M_s$ are integers, $a_{0_{m_1}}$ and $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above.

An exemplary string with a characteristic modulation having a frequency within the band represented by $e^{-jk_\rho(\rho_{fb_m}+\rho_{t_m})}$ is:

$$\sum_{s=1}^{S}\sum_{m=1}^{M_s}\sum_{n=-\infty}^{\infty} \frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}} a_{0_{s,m}} N_{s,m_{\rho_0}} N_{s,m_{z_0}} e^{-jk_\rho\left(\rho_{fb_{s,m}}+\rho_{t_{s,m}}\right)}$$
$$\sin\left(\left(k_\rho - n\frac{2\pi}{\rho_{0_{s,m}}}\right)\frac{N_{s,m_{\rho_0}}\rho_{0_{s,m}}}{2}\right)\sin\left(\left(k_z - n\frac{2\pi}{z_{0_{s,m}}}\right)\frac{N_{s,m_{z_0}}z_{0_{s,m}}}{2}\right)$$

wherein $\rho_{t_{s,m}} = v_{t_{s,m}}t_{t_{s,m}}$ is the modulation factor which corresponds to the physical time delay $t_{t_{s,m}}$, $\rho_{fb_{s,m}} = v_{fb_{s,m}}t_{fb_{s,m}}$ is the modulation factor which corresponds to the specific transducer time delay $t_{fb_{s,m}}$, $v_{t_{s,m}}$ and $v_{fb_{s,m}}$ are constants such as the signal propagation velocities, $a_{0_{s,m}}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, $s$, $M_s$, and $S$ are integers, and $N_{s,m_{\rho_0}}$, $N_{s,m_{z_0}}$, $\rho_{0_{s,m}}$, and $z_{0_{s,m}}$ are data parameters. The data parameters are selected in the same manner as described above.

An exemplary string with each Fourier series multiplied by the Fourier transform of the delayed Gaussian filter represented by $e^{-\frac{1}{2}\left(v_{\rho 0}\frac{k_\rho}{\alpha_{\rho 0}}\right)^2} e^{-j\frac{\sqrt{N_{\rho 0}}}{\alpha_{\rho 0}}(v_{\rho 0}k_\rho)} e^{-\frac{1}{2}\left(v_{z0}\frac{k_z}{\alpha_{z0}}\right)^2} e^{-j\frac{\sqrt{N_{z0}}}{\alpha_{z0}}(v_{z0}k_z)}$ that established the association to form the string is:

$$\sum_{s=1}^{S}\sum_{m=1}^{M_s}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}a_{0_{s,m}}N_{s,m_{\rho_0}}N_{s,m_{z_0}}e^{-\frac{1}{2}\left(v_{s\rho 0}\frac{k_\rho}{\alpha_{s\rho 0}}\right)^2}e^{-j\frac{\sqrt{N_{s\rho 0}}}{\alpha_{s\rho 0}}(v_{s\rho 0}k_\rho)}e^{-\frac{1}{2}\left(v_{sz0}\frac{k_z}{\alpha_{sz0}}\right)^2}e^{-j\frac{\sqrt{N_{sz0}}}{\alpha_{sz0}}(v_{sz0}k_z)}$$

$$e^{-jk_\rho\left(\rho_{fb_{s,m}}+\rho_{t_{s,m}}\right)}\sin\left(\left(k_\rho-n\frac{2\pi}{\rho_{0_{s,m}}}\right)\frac{N_{s,m_{\rho 0}}\rho_{0_{s,m}}}{2}\right)\sin\left(\left(k_z-n\frac{2\pi}{v_{s,m}t_{0_{s,m}}}\right)\frac{N_{s,m_{z0}}z_{0_{s,m}}}{2}\right)$$

wherein $v_{s\rho_0}$ and $v_{sz_0}$ are constants such as the signal propagation velocities in the $\rho$ and $z$ directions, respectively, $\frac{\sqrt{N_{s\rho 0}}}{\alpha_{s\rho 0}}$ and $\frac{\sqrt{N_{sz0}}}{\alpha_{sz0}}$ are delay parameters and $\alpha_{s\rho_0}$ and $\alpha_{sz_0}$ are half-width parameters of a corresponding Gaussian filter in the $\rho$ and $z$ directions, respectively, $\rho_{t_{s,m}}=v_{t_{s,m}}t_{t_{s,m}}$ is the modulation factor which corresponds to the physical time delay $t_{t_{s,m}}$, $\rho_{fb_{s,m}}=v_{fb_{s,m}}t_{fb_{s,m}}$ is the modulation factor which corresponds to the specific transducer time delay $t_{fb_{s,m}}$, $v_{t_{s,m}}$ and $v_{fb_{s,m}}$ are constants such as the signal propagation velocities, $a_{0_{s,m}}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, $s$, $M_s$, and $S$ are integers, and $N_{s,m_{\rho_0}}$, $N_{s,m_{z_0}}$, $\rho_{0_{s,m}}$, and $z_{0_{s,m}}$ are data parameters. The data parameters are selected in the same manner as described above.

Therein, the Association Layer forms associations between Fourier series and sums the associated Fourier series to form a string. The string is then stored in the string memory section.

The output of associations between Fourier series in Fourier space constitutes the recognition of a pattern in the processed information. Thus, recognition of a pattern has clear utility under 35 U.S.C. § 101.

With regard to the rejection of claims 307-322 under 35 U.S.C. § 101, because the claimed invention is allegedly directed to non-statutory subject matter, the Examiner argues on pages 21-22 of the Answer that:

Appellant's argument --

For Claims 307-322, the Examiner fails to discuss how he considers the claims to be data structures, per se, in view of the specific claim limitations cited by the Appeals Board in its May 22, 2005 Decision. Contrary to his conclusory remarks provided in the previous office action, the Examiner further errs in failing to appreciate that the data are functional. The transduced data objects are processed to form a

representation of the information contained in the data from a detector in the form of a Fourier series in Fourier space. The data is used as parameters that are input to the system and means to process and achieve pattern recognition and processing.

Examiner's response --

a. <u>With regard to Claims 307-322</u>

As discussed above, the data are stored as the Appellant termed as data structure. They are just collection of data or calculation results stored in a memory. For the data structure to be statutory subject matter, it needs to support specific data manipulation function. As explained above, the usage of the stored data as suggested by the Appellant does not have an operational function for providing utility. Therefore, it does not support manipulation function that is alleged to provide the utility. The data structure as a collection of data values thus is only Non-functional descriptive material.

Once again, the Examiner's latest arguments are wholly without merit. It is easy to appreciate that the data structure supports specific data manipulation functions. For example, equations that utilize the data structure to determine spectral similarity are given at page 14, line 4 to page 15, line 8 of the application:

Thus, the probability expectation value can be based upon Poissonian probability. The probability expectation value may be characterized by

$$\prod_s \left[ p_{\uparrow_s} + \left(P - p_{\uparrow_s}\right) \exp\left[-\beta_s^{-2}\left(\frac{1-\cos 2\phi_s}{2}\right)\right] \cos\left(\delta_s + 2\sin\phi_s\right)\right]$$

wherein $P$ is the maximum probability of at least one other Fourier series being associated with a first Fourier series, $p_{\uparrow_s}$ is a probability of at least one other Fourier series being associated with a first Fourier series in the absence of coupling of the first Fourier series with the at least one other Fourier series, $\beta_s^2$ is a number that represents the amplitude of spectral similarity between at least two filtered or unfiltered Fourier series, $\phi_s$ represents the frequency difference angle between at least two filtered or unfiltered Fourier series, and $\delta_s$, is a phase factor. $\beta_s^2$ may be characterized by

$$\beta_s^2 = (8\pi)^2 \frac{1}{\sqrt{2\pi}} \sqrt{\frac{\alpha_1^2 \alpha_s^2}{\alpha_1^2 + \alpha_s^2}}$$

$$\sum_{m_1=1}^{M_1} a_{0_{m_1}} N_{m_1} \sum_{m_s=1}^{M_s} a_{0_{m_s}} N_{m_s} \exp - \left\{ \frac{\frac{\alpha_1^2 \alpha_s^2}{\alpha_1^2 + \alpha_s^2} \left( \frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \frac{N_{m_1} \rho_{0_{m_1}}}{2 v_{m_1}} - \frac{N_{m_s} \rho_{0_{m_s}}}{2 v_{m_s}} \right)^2}{2} \right\}$$

$\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$ and $M_s$ are integers, $a_{0_{m_1}}$ and $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above. $\phi_s$ may be characterized by

$$\phi_s = \frac{\pi \left( \frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \sum_{m_1=1}^{M_1} \frac{N_{m_1} \rho_{0_{m_1}}}{2 v_{m_1}} - \sum_{m_s=1}^{M_s} \frac{N_{m_s} \rho_{0_{m_s}}}{2 v_{m_s}} \right)}{\frac{\sqrt{N_1}}{\alpha_1} + \sum_{m_1=1}^{M_1} \frac{N_{m_1} \rho_{0_{m_1}}}{2 v_{m_1}}}$$

$\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$ and $M_s$ are integers, $a_{0_{m_1}}$ and $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above.

The selection of the data parameters is based on the data structure which encodes information and may also encode context. For example, equations that utilize the data structure to determine spectral similarity with encoded context are given at page 19, line 13 to page 21, line 5 of the application:

The probability expectation value may be based upon Poissonian probability. The probability expectation value is represented by

$$\prod_s \left[ p_{\uparrow_s} + (P - p_{\uparrow_s}) \exp\left[ -\beta_s^{-2} \left( \frac{1 - \cos 2\phi_s}{2} \right) \right] \cos(\delta_s + 2 \sin \phi_s) \right]$$

wherein $P$ is the maximum probability of at least one other Fourier series being associated with a first Fourier series, $p_{\uparrow_s}$ is a probability of at least one other Fourier series being associated with a first Fourier series in the absence of coupling of the first Fourier series with the at least one other Fourier series, $\beta_s^2$ is a number that represents the amplitude of spectral similarity between at least two filtered or unfiltered Fourier series, $\phi_s$ represents the frequency difference angle between at least two filtered or unfiltered Fourier series, and $\delta_s$, is a phase factor. $\beta_s^2$ may be characterized by

$$\beta_s^2 = (8\pi)^2 \frac{1}{\sqrt{2\pi}} \sqrt{\frac{\alpha_1^2\alpha_s^2}{\alpha_1^2+\alpha_s^2}} \sum_{m_1=1}^{M_1} a_{0_{m_1}} N_{m_1} \sum_{m_s=1}^{M_s} a_{0_{m_s}} N_{m_s}$$

$$\exp - \left\{ \frac{\frac{\alpha_1^2\alpha_s^2}{\alpha_1^2+\alpha_s^2}\left(\frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \left(\frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} + \frac{\rho_{fb_{m_1}}}{v_{fb_{m_1}}} + \frac{\rho_{t_{m_1}}}{v_{t_{m_1}}}\right) - \left(\frac{N_{m_s}\rho_{0_{m_s}}}{2v_{m_s}} + \frac{\rho_{fb_{m_s}}}{v_{fb_{m_s}}} + \frac{\rho_{t_{m_s}}}{v_{t_{m_s}}}\right)\right)^2}{2} \right\}$$

wherein $\rho_{t_{m_1}} = v_{t_{m_1}} t_{t_{m_1}}$ and $\rho_{t_{m_s}} = v_{t_{m_s}} t_{t_{m_s}}$ are the modulation factors which corresponds to the physical time delays $t_{t_{m_1}}$ and $t_{t_{m_s}}$, respectively, $\rho_{fb_{m_1}} = v_{fb_{m_1}} t_{fb_{m_1}}$ and $\rho_{fb_{m_s}} = v_{fb_{m_s}} t_{fb_{m_s}}$ are the modulation factors which corresponds to the specific transducer time delay $t_{fb_{m_1}}$ and $t_{fb_{m_s}}$, respectively, $v_{t_{m_1}}$, $v_{t_{m_s}}$, $v_{fb_{m_1}}$, and $v_{fb_{m_s}}$ are constants such as the signal propagation velocities, $\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$ and $M_s$ are integers, $a_{0_{m_1}}$, $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above. $\phi_s$ may be represented by

$$\phi_s = \frac{\pi\left(\frac{\sqrt{N_1}}{\alpha_1} - \frac{\sqrt{N_s}}{\alpha_s} + \sum_{m_1=1}^{M_1}\left(\frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} + \frac{\rho_{fb_{m_1}}}{v_{fb_{m_1}}} + \frac{\rho_{t_{m_1}}}{v_{t_{m_1}}}\right) - \sum_{m_s=1}^{M_s}\left(\frac{N_{m_s}\rho_{0_{m_s}}}{2v_{m_s}} + \frac{\rho_{fb_{m_s}}}{v_{fb_{m_s}}} + \frac{\rho_{t_{m_s}}}{v_{t_{m_s}}}\right)\right)}{\frac{\sqrt{N_1}}{\alpha_1} + \sum_{m_1=1}^{M_1}\left(\frac{N_{m_1}\rho_{0_{m_1}}}{2v_{m_1}} + \frac{\rho_{fb_{m_1}}}{v_{fb_{m_1}}} + \frac{\rho_{t_{m_1}}}{v_{t_{m_1}}}\right)}$$

wherein $\rho_{t_{m_1}} = v_{t_{m_1}} t_{t_{m_1}}$ and $\rho_{t_{m_s}} = v_{t_{m_s}} t_{t_{m_s}}$ are the modulation factors which corresponds to the physical time delays $t_{t_{m_1}}$ and $t_{t_{m_s}}$, respectively, $\rho_{fb_{m_1}} = v_{fb_{m_1}} t_{fb_{m_1}}$ and $\rho_{fb_{m_s}} = v_{fb_{m_s}} t_{fb_{m_s}}$ are the modulation factors which corresponds to the specific transducer time delay $t_{fb_{m_1}}$ and $t_{fb_{m_s}}$, respectively, $v_{t_{m_1}}$, $v_{t_{m_s}}$, $v_{fb_{m_1}}$, and $v_{fb_{m_s}}$ are constants such as the signal propagation velocities, $\frac{\sqrt{N_1}}{\alpha_1}$ and $\frac{\sqrt{N_s}}{\alpha_s}$ correspond to delay parameters of a first and s-th time delayed Gaussian filter, respectively, $\alpha_1$ and $\alpha_s$ corresponding half-width parameters of a first and s-th time delayed Gaussian filter, respectively, $M_1$, and $M_s$ are integers, $a_{0_{m_1}}$ and $a_{0_{m_s}}$ are constants, $v_{m_1}$ and $v_{m_s}$ are constants such as the signal propagation velocities, and $N_{m_1}$, $N_{m_s}$, $\rho_{0_{m_1}}$, and $\rho_{0_{m_s}}$ are data parameters. The data parameters are selected in the same manner as described above.

The retrieval data structure that encodes information and enables the use of the above equations to achieve processing and pattern recognition is disclosed at page 7, line 35 to page 12, line 2 of the application:

> The following example illustrates how the present invention processes the physical characteristics of an item of interest, specifically a triangle. In flat geometry, the physical characteristics of a triangle are three connected lines at angles aggregating to 180°. The physical characteristics provide spatial variations of light scattering. In one embodiment, a light responsive transducer (not shown) of the system 10 transduces the light scattering into the data. An exemplary transducer is a charge coupled device ("CCD") array. One data element at a point in time may be a voltage of a particular CCD element of the CCD array. Each CCD element of the CCD array has a spatial identity. The physical context for the triangle is the relationship of the lines at the corresponding angles providing a spatial variation of light scattering. The input context is the identity of each CCD element that responds according to the physical context. For example, a CCD element (100,13) of a 512 by 512 CCD array will uniquely respond to light scattered by the lines and angular relations of the triangle relative to the other CCD elements of the CCD array. The response is stored in a specific memory register of an Input Layer section of the memory 20. The specific memory register is reflective of the input context. In the present invention, a Fourier series in Fourier space represents the information of the triangle parameterized according to the voltage and the CCD element identity.
>
> Referring to FIGURE 2, in the first step, the Input Layer 12 receives the data from the transducer (not shown). A Fourier transform processor

22 encodes each data element as parameters of a Fourier component in Fourier space and stores the data parameter values to the Input Layer section 24 of the memory 20. Each Fourier component of the Fourier series may comprise a quantized amplitude, frequency, and phase angle. For example the Fourier series in Fourier space may be:

$$\sum_{m=1}^{M}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}a_{0_m}N_{m_{\rho_0}}N_{m_{z_0}}\sin\left(\left(k_\rho-n\frac{2\pi}{\rho_{0_m}}\right)\frac{N_{m_{\rho_0}}\rho_{0_m}}{2}\right)\sin\left(\left(k_z-n\frac{2\pi}{z_{0_m}}\right)\frac{N_{m_{z_0}}z_{0_m}}{2}\right)$$

having a quantized amplitude, frequency, and phase angle, wherein $a_{0_m}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, and $M$ are integers, and $N_{m_{\rho_0}}$, $N_{m_{z_0}}$, $\rho_{0_m}$, and $z_{0_m}$ are the data parameters.

In a first embodiment, the data parameters $N_{m_{\rho_0}}$ and $N_{m_{z_0}}$ of the Fourier series component are proportional to the rate of change of the physical characteristic. Each of the data parameters $\rho_{0_m}$ and $z_{0_m}$ of each Fourier component is inversely proportional to the amplitude of the physical characteristic. In the triangle example, the amplitude of the voltage at a given CCD element relative to the neighboring CCD element defines the rate of change of the voltage which is converted into the data parameters $N_{m_{\rho_0}}$ and $N_{m_{z_0}}$. The inverse of the amplitude of the voltage of each CCD element is converted into the data parameters $\rho_{0_m}$ and $z_{0_m}$. As illustrated in FIGURE 3 and described above, for each CCD element, the Fourier series, parameterized accordingly, are stored to a specific sub register 27 of a specific register 26 of the Input Layer section 24 of the memory 20. Since the structure of a Fourier series is known in the art, only the parameters need to be stored in a digital embodiment.

The number and types of transducers that may supply information to the system is only limited by available technology, hardware and economics, as is the number $m$ of corresponding registers 26 for each transducer. Each register 26 may have any number $d$ of subregisters 27, where the number $d$ of subregisters of one register 26 is not necessarily the same as other registers 26. For example, "Level 1 " register "1 " may have thirty "Level 2 " subregisters 27 and "Level 1 " register "2 " may have one-hundred subregisters 27. Furthermore, each "Level 2 " register may have any number $e$ of subregisters, where the number $e$ of subregisters of one register 27 is not necessarily the same as other registers 27. For example, "Level 2 " register "1 " may have fifty "Level $n$" subregisters 29 and "Level 2 " register "2 " may have seventy "Level $n$" subregisters 29. Still further, each "Level $n$" register 29 may have any number $f$ of time buffer elements 31, where the number $f$ of time buffer elements 31 is not necessarily the same as other time buffer elements 31.

In a second embodiment, each of the data parameters $N_{m_{\rho_0}}$ and $N_{m_{z_0}}$ of the Fourier series component is proportional to the amplitude of the physical characteristic. Each of the data parameters $\rho_{0_m}$ and $z_{0_m}$ of each Fourier component is inversely proportional to the rate of change of the physical characteristic. As in the first embodiment, for each CCD element, these parameters are stored in a specific sub register of the Input Layer section of the memory.

In a third embodiment, each of the data parameters $N_{m_{\rho_0}}$ and $N_{m_{z_0}}$ of the Fourier series component is proportional to the duration of the signal response of each transducer. Each of the data parameters $\rho_{0_m}$ and $z_{0_m}$ of each Fourier component is inversely proportional to the physical characteristic. As in the first embodiment, for each CCD element, these parameters are stored in a specific sub register of the Input Layer section of the memory.

As an alternative example, the Fourier series in Fourier space may be:

$$\sum_{m=1}^{M}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}\frac{4}{\rho_{0_m}z_{0_m}}a_{0_m}\sin\left(\left(k_\rho-n\frac{2\pi}{\rho_{0_m}}\right)\frac{N_{m_{\rho 0}}\rho_{0_m}}{2}\right)\sin\left(\left(k_z-n\frac{2\pi}{z_{0_m}}\right)\frac{N_{m_{z0}}z_{0_m}}{2}\right)$$

having a quantized frequency, and phase angle, wherein $a_{0_m}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, and $M$ are integers, and $N_{m_{\rho_0}}$, $N_{m_{z_0}}$, $\rho_{0_m}$, and $z_{0_m}$ are the data parameters. As described with respect to the previous example, for each CCD element, these parameters are stored in a specific sub register of the Input Layer section of the memory.

The physical context is conserved by mapping with a one to one basis between the physical context and the input context based on the identity of each transducer. The input context is conserved by mapping on a one to one basis to the Input Layer section 24 of memory 20. In an embodiment, the input context is encoded in time as a characteristic modulation frequency band in Fourier space of the Fourier series. The characteristic modulation frequency band in Fourier space represents the input context according to the identity of a specific transducer of the relationship of two transducer elements. The modulation within each frequency band may encode not only input context but context in a general sense. The general context may encode temporal order, cause and effect relationships, size order, intensity order, before-after order, top-bottom order, left-right order, etc. all of which are relative to the transducer.

Still referring to FIGURE 3, the transducer has $n$ levels of subcomponents. Each transducer is assigned a portion 26 of the Input Layer section 24 of the memory 20. The memory 20 is arranged in a

hierarchical manner. Specifically, the memory is divided and assigned to correspond to a master time interval with $n+1$ sub time intervals. The hierarchy parallels the $n$ levels of the transducer subcomponents. The $n$ th level transducer sub component provides a data stream to the system 10. The data stream is recorded as a function of time in the $n+1$ sub time interval. The time intervals represent time delays which correspond to the characteristic modulation frequency band in Fourier space which in turn represents the input context according to the specific transducer or transducer subcomponent.

An exemplary complex transducer which may be represented by a data structure comprising a hierarchical set of time delay intervals is a CCD array of a video camera comprising a multitude of charge coupled devices (CCDs). Each CCD comprises a transducer element and is responsive to light intensity of a given wavelength band at a given spatial location in a grid. Another example of a transducer is an audio recorder comprising transducer elements each responsive to sound intensity of a given frequency band at a given spatial location or orientation. A signal within the band 300-400 MHz may encode and identify the signal as a video signal; whereas, a signal within the band 500-600 MHz may encode and identify the signal as an audio signal. Furthermore, a video signal within the band 315-325 MHz may encode and identify the signal as a video signal as a function of time of CCD element (100,13) of a 512 by 512 array of CCDs.

In one embodiment, the characteristic modulation having a frequency within the band in Fourier space is represented by $e^{-j2\pi f t_0}$. The modulation corresponds to the time delay $\delta(t-t_0)$ wherein $f$ is the frequency variable, $t$ is the time variable, and $t_0$ is the time delay. The characteristic modulation is encoded as a delay in time by storing the Fourier series in a specific portion of the Input Layer section of the memory wherein the specific portion has $n+1$ sub time intervals. Each sub time interval corresponds to a frequency band.

In an alternative embodiment, the characteristic modulation, having a frequency within the band is represented by $e^{-jk_\rho(\rho_{fb_m}+\rho_{t_m})}$. Thus, the Fourier series in Fourier space may be:

$$\sum_{m=1}^{M}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}a_{0_m}N_{m_{\rho_0}}N_{m_{z_0}}e^{-jk_\rho(\rho_{fb_m}+\rho_{t_m})}\sin\left(k_\rho\frac{N_{m_{\rho 0}}\rho_{0_m}}{2}-n\frac{2\pi N_{m_{\rho 0}}}{2}\right)\sin\left(k_z\frac{N_{m_{z0}}z_{0_m}}{2}-n\frac{2\pi N_{m_{z0}}}{2}\right)$$

wherein $\rho_{t_m}=v_{t_m}t_{t_m}$ is the modulation factor which corresponds to the physical time delay $t_{t_m}$, $\rho_{fb_m}=v_{fb_m}t_{fb_m}$ is the modulation factor which corresponds to the specific transducer time delay $t_{fb_m}$, $v_{t_m}$ and $v_{fb_m}$ are constants such as the signal propagation velocities, $a_{0_m}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, and $M$ are integers, and $N_{m_{\rho_0}}$,

$N_{m_{z_0}}$, $\rho_{0_m}$, and $z_{0_m}$ are data parameters. The data parameters are selected in the same manner as described above.

With regard to claims 313-314 and 316-322, the Examiner again errs on pages 22-24 of the Answer in arguing that:

> Please note that the Examiner did not reject the claims as data structure per se as alleged by the Appellant. The Examiner clearly indicated that the claims recite a data structure in a memory. However, the recited features in the claim body do not constitute a functional description material. So the key question is that whether the claimed subject mailer is nonfunctional or not.
>
> Claim 313 is reproduced below.
>
> 313. (Previously Presented) A data structure in a memory for access by a computer program for efficient recognition of a pattern in information comprising data stored in the memory, the data structure comprising:
>
> a plurality of transduced data objects, each of said plurality of transduced data objects providing an input data object representative of characteristics received from a respective one of a plurality of transducers acting on a signal provided by characteristics encoded as a Fourier series in Fourier space, wherein said input data objects allows associations among and relational pattern of said input data objects by spectral analysis to achieve recognition of a pattern in information, while preserving input context of said input signal including an identity of said respective one of said plurality of transducers.
>
> Claim 313 basically recites a data structure in a memory for an application, the data structure comprising a plurality of transduced data objects. The recitation of the following in the body of the claim is an intended-use limitation and contributes no weight in defining the claimed scope:
>
> "each of said plurality of transduced data objects providing an input data object representative of characteristics received from a respective one of a plurality of transducers acting on a signal provided by characteristics encoded as a Fourier series in Fourier space, wherein said input data objects allows associations among and relational pattern of said input data objects by spectral analysis to achieve recognition of a pattern in information, while preserving input context of said input signal including an identity of said respective one of said plurality of transducers."

For example, a camera consisting of a plurality of pixel sensing element is used to capture an image. Each sensing element of the camera is a transducer for transferring light into electronic signal. The electronic signal is then stored in a memory as transduced data objects. The data objects can be inputted in a processor for various images processing including the intended use of association with spectral analysis. Because Claim 313 basically recites a data structure in a memory, the data structure comprising a plurality of transduced data objects for some intended use, the picture data taken by a camera and stored in a memory meet the recited requirement. It is well known in the art that picture data stored in a memory are just nonfunctional information. For example, a picture has only non-functional information. A plurality of transduced data objects outputted from a camera does not have physical or logical relationship to support specific data manipulation function, because pictures taken by a camera change from picture to picture according to scene change and thus do not have any well-defined relationship among pixels in an image. A machine or processor can process the image to output useful information. However, the functionality is provided by the machine or processor, not by the compilation of data which is termed as data structure here.

***In page 39 of the present Appeal Brief, the Appellant correctly admitted that raw data without formatting and organization and without subsequent processing as taught by Appellant has no utility to achieve pattern recognition or processing.*** *Claim 313 as recited includes at least a species of only raw image data stored in a memory. Claim 313 as recited includes at least a species of non-functional data stored in a memory Therefore, although a data structure in a memory is not data per se because of the existence of the memory **it** just contains non-functional material stored in a memory which is non-statutory.*

For Claim 314 and 316-322, without a plurality of order formatted data objects, the functionality of the data structure cannot be realized.
The essential feature of the data structure that is missed by the Examiner is that it encodes the physical characteristics and context of the data based on the organization or structure and formatting of the stored data parameters. The Examiner's example of recalled data to form a camera image is not received with an input context representative of physical characteristics encoded in the data. The claim makes a distinction "characteristics encoded as a Fourier series in Fourier space" to uniquely encode the physical characteristics and context of the data. This essential feature for subsequent processing and pattern recognition is absent from the stored pixel image data as taught in the prior art. This is evident from even the abstract:

Abstract

> The present invention provides a method and system for pattern recognition and processing. Information representative of physical characteristics or representations of physical characteristics is transformed into a Fourier series in Fourier space within an input context of the physical characteristics that is encoded in time as delays corresponding to modulation of the Fourier series at corresponding frequencies. Associations are formed between Fourier series by filtering the Fourier series and by using a spectral similarity between the filtered Fourier series to determine the association based on Poissonian probability. The associated Fourier series are added to form strings of Fourier series. Each string is ordered by filtering it with multiple selected filters to form multiple time order formatted subset Fourier series, and by establishing the order through associations with one or more initially ordered strings to form an ordered string. Associations are formed between the ordered strings to form complex ordered strings that relate similar items of interest. The components of the invention are active based on probability using weighting factors based on activation rates.

and the relationship between the data structure and the novel function of the method and system. See page 7, line 35 to page 12, line 2 of the application:

> The following example illustrates how the present invention processes the physical characteristics of an item of interest, specifically a triangle. In flat geometry, the physical characteristics of a triangle are three connected lines at angles aggregating to 180°. The physical characteristics provide spatial variations of light scattering. In one embodiment, a light responsive transducer (not shown) of the system 10 transduces the light scattering into the data. An exemplary transducer is a charge coupled device ("CCD") array. One data element at a point in time may be a voltage of a particular CCD element of the CCD array. Each CCD element of the CCD array has a spatial identity. The physical context for the triangle is the relationship of the lines at the corresponding angles providing a spatial variation of light scattering. The input context is the identity of each CCD element that responds according to the physical context. For example, a CCD element (100,13) of a 512 by 512 CCD array will uniquely respond to light scattered by the lines and angular relations of the triangle relative to the other CCD elements of the CCD array. The response is stored in a specific memory register of an Input Layer section of the memory 20. The specific memory register is reflective of the input context. In the present invention, a Fourier series in Fourier space represents the information of the triangle parameterized according to the voltage and the CCD element identity.

Referring to FIGURE 2, in the first step, the Input Layer 12 receives the data from the transducer (not shown). A Fourier transform processor 22 encodes each data element as parameters of a Fourier component in Fourier space and stores the data parameter values to the Input Layer section 24 of the memory 20. Each Fourier component of the Fourier series may comprise a quantized amplitude, frequency, and phase angle. For example the Fourier series in Fourier space may be:

$$\sum_{m=1}^{M}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}a_{0_m}N_{m_{\rho_0}}N_{m_{z_0}}\sin\left(\left(k_\rho-n\frac{2\pi}{\rho_{0_m}}\right)\frac{N_{m_{\rho_0}}\rho_{0_m}}{2}\right)\sin\left(\left(k_z-n\frac{2\pi}{z_{0_m}}\right)\frac{N_{m_{z_0}}z_{0_m}}{2}\right)$$

having a quantized amplitude, frequency, and phase angle, wherein $a_{0_m}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, and $M$ are integers, and $N_{m_{\rho_0}}$, $N_{m_{z_0}}$, $\rho_{0_m}$, and $z_{0_m}$ are the data parameters.

In a first embodiment, the data parameters $N_{m_{\rho_0}}$ and $N_{m_{z_0}}$ of the Fourier series component are proportional to the rate of change of the physical characteristic. Each of the data parameters $\rho_{0_m}$ and $z_{0_m}$ of each Fourier component is inversely proportional to the amplitude of the physical characteristic. In the triangle example, the amplitude of the voltage at a given CCD element relative to the neighboring CCD element defines the rate of change of the voltage which is converted into the data parameters $N_{m_{\rho_0}}$ and $N_{m_{z_0}}$. The inverse of the amplitude of the voltage of each CCD element is converted into the data parameters $\rho_{0_m}$ and $z_{0_m}$. As illustrated in FIGURE 3 and described above, for each CCD element, the Fourier series, parameterized accordingly, are stored to a specific sub register 27 of a specific register 26 of the Input Layer section 24 of the memory 20. Since the structure of a Fourier series is known in the art, only the parameters need to be stored in a digital embodiment.

The number and types of transducers that may supply information to the system is only limited by available technology, hardware and economics, as is the number $m$ of corresponding registers 26 for each transducer. Each register 26 may have any number $d$ of subregisters 27, where the number $d$ of subregisters of one register 26 is not necessarily the same as other registers 26. For example, "Level 1 " register "1 " may have thirty "Level 2 " subregisters 27 and "Level 1 " register "2 " may have one-hundred subregisters 27. Furthermore, each "Level 2 " register may have any number $e$ of subregisters, where the number $e$ of subregisters of one register 27 is not necessarily the same as other registers 27. For example, "Level 2 " register "1 " may have fifty "Level $n$" subregisters 29 and "Level 2 " register "2 " may have seventy "Level $n$" subregisters 29. Still further, each "Level $n$" register 29 may have any number $f$ of time buffer elements 31, where the number $f$ of time buffer elements 31 is not necessarily the same as other time buffer elements 31.

In a second embodiment, each of the data parameters $N_{m_{\rho_0}}$ and $N_{m_{z_0}}$ of the Fourier series component is proportional to the amplitude of the physical characteristic. Each of the data parameters $\rho_{0_m}$ and $z_{0_m}$ of each Fourier component is inversely proportional to the rate of change of the physical characteristic. As in the first embodiment, for each CCD element, these parameters are stored in a specific sub register of the Input Layer section of the memory.

In a third embodiment, each of the data parameters $N_{m_{\rho_0}}$ and $N_{m_{z_0}}$ of the Fourier series component is proportional to the duration of the signal response of each transducer. Each of the data parameters $\rho_{0_m}$ and $z_{0_m}$ of each Fourier component is inversely proportional to the physical characteristic. As in the first embodiment, for each CCD element, these parameters are stored in a specific sub register of the Input Layer section of the memory.

As an alternative example, the Fourier series in Fourier space may be:

$$\sum_{m=1}^{M}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}\frac{4}{\rho_{0_m}z_{0_m}}a_{0_m}\sin\left(\left(k_\rho-n\frac{2\pi}{\rho_{0_m}}\right)\frac{N_{m_{\rho_0}}\rho_{0_m}}{2}\right)\sin\left(\left(k_z-n\frac{2\pi}{z_{0_m}}\right)\frac{N_{m_{z_0}}z_{0_m}}{2}\right)$$

having a quantized frequency, and phase angle, wherein $a_{0_m}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, and $M$ are integers, and $N_{m_{\rho_0}}$, $N_{m_{z_0}}$, $\rho_{0_m}$, and $z_{0_m}$ are the data parameters. As described with respect to the previous example, for each CCD element, these parameters are stored in a specific sub register of the Input Layer section of the memory.

The physical context is conserved by mapping with a one to one basis between the physical context and the input context based on the identity of each transducer. The input context is conserved by mapping on a one to one basis to the Input Layer section 24 of memory 20. In an embodiment, the input context is encoded in time as a characteristic modulation frequency band in Fourier space of the Fourier series. The characteristic modulation frequency band in Fourier space represents the input context according to the identity of a specific transducer of the relationship of two transducer elements. The modulation within each frequency band may encode not only input context but context in a general sense. The general context may encode temporal order, cause and effect relationships, size order, intensity order, before-after order, top-bottom order, left-right order, etc. all of which are relative to the transducer.

Still referring to FIGURE 3, the transducer has $n$ levels of subcomponents. Each transducer is assigned a portion 26 of the Input Layer section 24 of the memory 20. The memory 20 is arranged in a

hierarchical manner. Specifically, the memory is divided and assigned to correspond to a master time interval with $n+1$ sub time intervals. The hierarchy parallels the $n$ levels of the transducer subcomponents. The $n$ th level transducer sub component provides a data stream to the system 10. The data stream is recorded as a function of time in the $n+1$ sub time interval. The time intervals represent time delays which correspond to the characteristic modulation frequency band in Fourier space which in turn represents the input context according to the specific transducer or transducer subcomponent.

An exemplary complex transducer which may be represented by a data structure comprising a hierarchical set of time delay intervals is a CCD array of a video camera comprising a multitude of charge coupled devices (CCDs). Each CCD comprises a transducer element and is responsive to light intensity of a given wavelength band at a given spatial location in a grid. Another example of a transducer is an audio recorder comprising transducer elements each responsive to sound intensity of a given frequency band at a given spatial location or orientation. A signal within the band 300-400 MHz may encode and identify the signal as a video signal; whereas, a signal within the band 500-600 MHz may encode and identify the signal as an audio signal. Furthermore, a video signal within the band 315-325 MHz may encode and identify the signal as a video signal as a function of time of CCD element (100,13) of a 512 by 512 array of CCDs.

In one embodiment, the characteristic modulation having a frequency within the band in Fourier space is represented by $e^{-j2\pi f t_0}$. The modulation corresponds to the time delay $\delta(t-t_0)$ wherein $f$ is the frequency variable, $t$ is the time variable, and $t_0$ is the time delay. The characteristic modulation is encoded as a delay in time by storing the Fourier series in a specific portion of the Input Layer section of the memory wherein the specific portion has $n+1$ sub time intervals. Each sub time interval corresponds to a frequency band.

In an alternative embodiment, the characteristic modulation, having a frequency within the band is represented by $e^{-jk_\rho(\rho_{fb_m}+\rho_{t_m})}$. Thus, the Fourier series in Fourier space may be:

$$\sum_{m=1}^{M}\sum_{n=-\infty}^{\infty}\frac{4\pi}{1+\frac{k_z^2}{k_\rho^2}}a_{0_m}N_{m_{\rho_0}}N_{m_{z_0}}e^{-jk_\rho(\rho_{fb_m}+\rho_{t_m})}\sin\left(k_\rho\frac{N_{m_{\rho 0}}\rho_{0_m}}{2}-n\frac{2\pi N_{m_{\rho 0}}}{2}\right)\sin\left(k_z\frac{N_{m_{z0}}z_{0_m}}{2}-n\frac{2\pi N_{m_{z0}}}{2}\right)$$

wherein $\rho_{t_m}=v_{t_m}t_{t_m}$ is the modulation factor which corresponds to the physical time delay $t_{t_m}$, $\rho_{fb_m}=v_{fb_m}t_{fb_m}$ is the modulation factor which corresponds to the specific transducer time delay $t_{fb_m}$, $v_{t_m}$ and $v_{fb_m}$ are constants such as the signal propagation velocities, $a_{0_m}$ is a constant, $k_\rho$ and $k_z$ are the frequency variables, $n$, $m$, and $M$ are integers, and $N_{m_{\rho_0}}$,

$N_{m_{z_0}}$, $\rho_{0_m}$, and $z_{0_m}$ are data parameters. The data parameters are selected in the same manner as described above.

In summary, Appellant respectfully submits that the Examiner has improperly mapped his misconceived view of the invention onto its unique data structures, equations, mechanisms, operations, steps, and layers. **The Examiner persists in viewing the invention from the perspective of representing a continuous-time waveform in terms of conventional Fourier series**, as opposed to what is taught, a Fourier-series in Fourier space parameterized with data to encode information that enables processing and pattern recognition. In addition to making conceptual mistakes, the Examiner has made fundamental mathematical mistakes. In view of Appellant's showing above, exposing the Examiner's multitude of erroneous arguments in his Answer, this application is now in condition for allowance.

## Conclusion

In view of the foregoing arguments, all of the pending claims 51-322 fully comply with 35 U.S.C. §§ 101 and 112, first paragraph. Accordingly, Appellant respectfully requests that the Board withdraw the Examiner's rejections of claims 51-322 and allow all of the claims in this case.

Respectfully submitted,

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